MACHINERY

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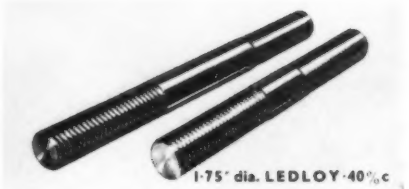
BRIGHT STEEL BARS
for increased production

·820" a/f LEDLOY E.N.I.A.



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MILLS LEDLOY bright steel bars contain a small percentage of lead, giving greatly improved machining properties to all standard qualities, Freecutting, Casehardening, Carbon, Heat-Treated Carbon and Alloy steels without impairing their physical properties in any way.
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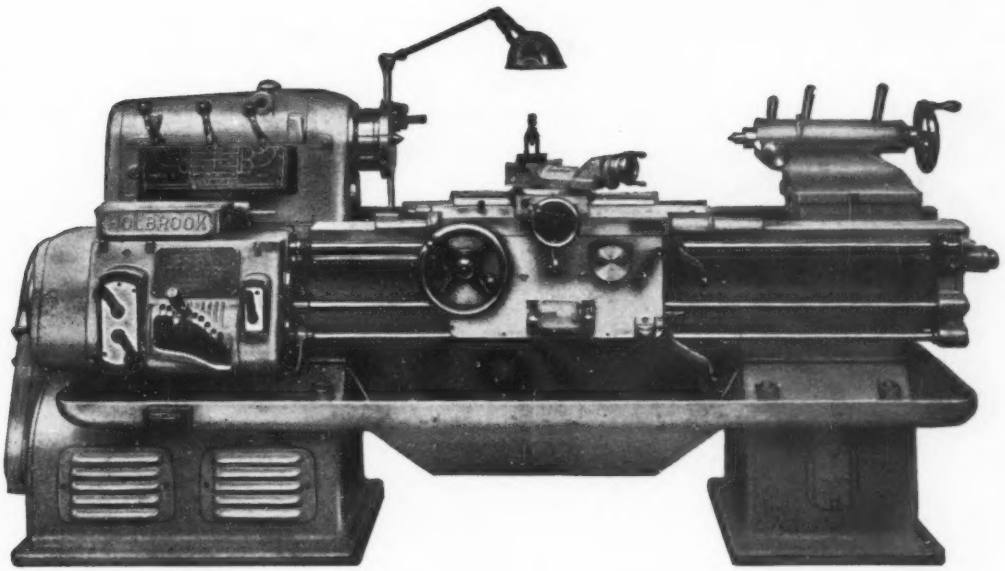

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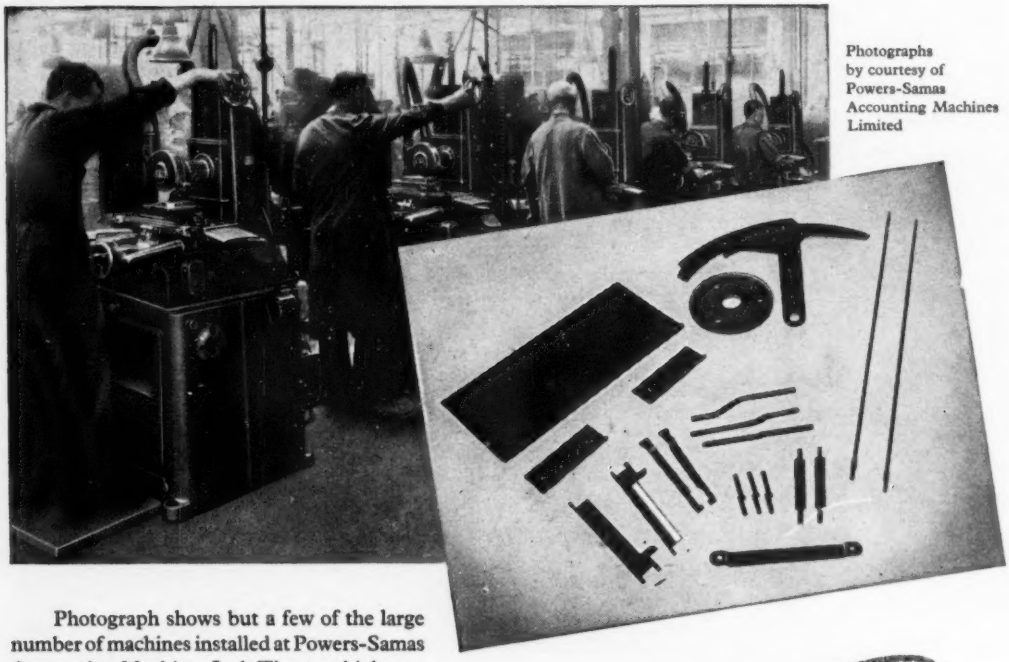

Photographs by courtesy of Powers-Samas Accounting Machines Limited

Photograph shows but a few of the large number of machines installed at Powers-Samas Accounting Machines Ltd. The very high percentage of repeat orders for EXE Grinders is positive proof of their precision and reliability.

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Table surface	12in. x 6¼ in.
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Our plant has been extended, as a matter of policy to look after outside contracts. Brown's will of course guarantee the highest possible accuracy, and welcome contracts calling for complete gear train assemblies. The following gears that can be cut include, Spur, Internal and Helical, Worm Wheels, Worms and Splines, in any recognised material. The categories are as follows:—

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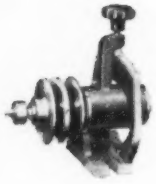

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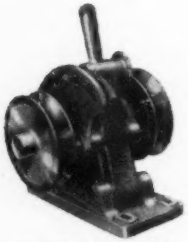

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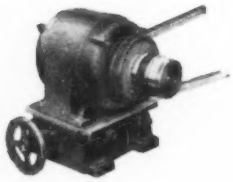

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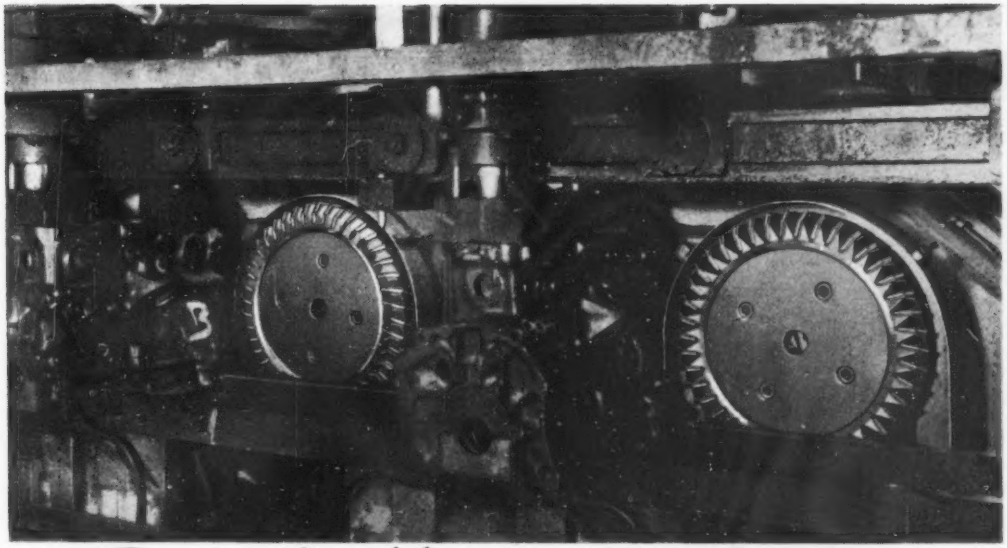

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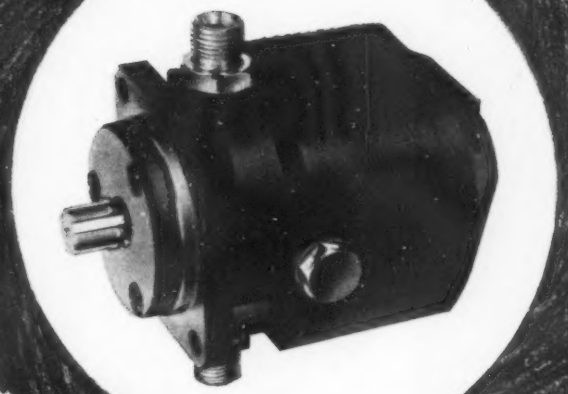

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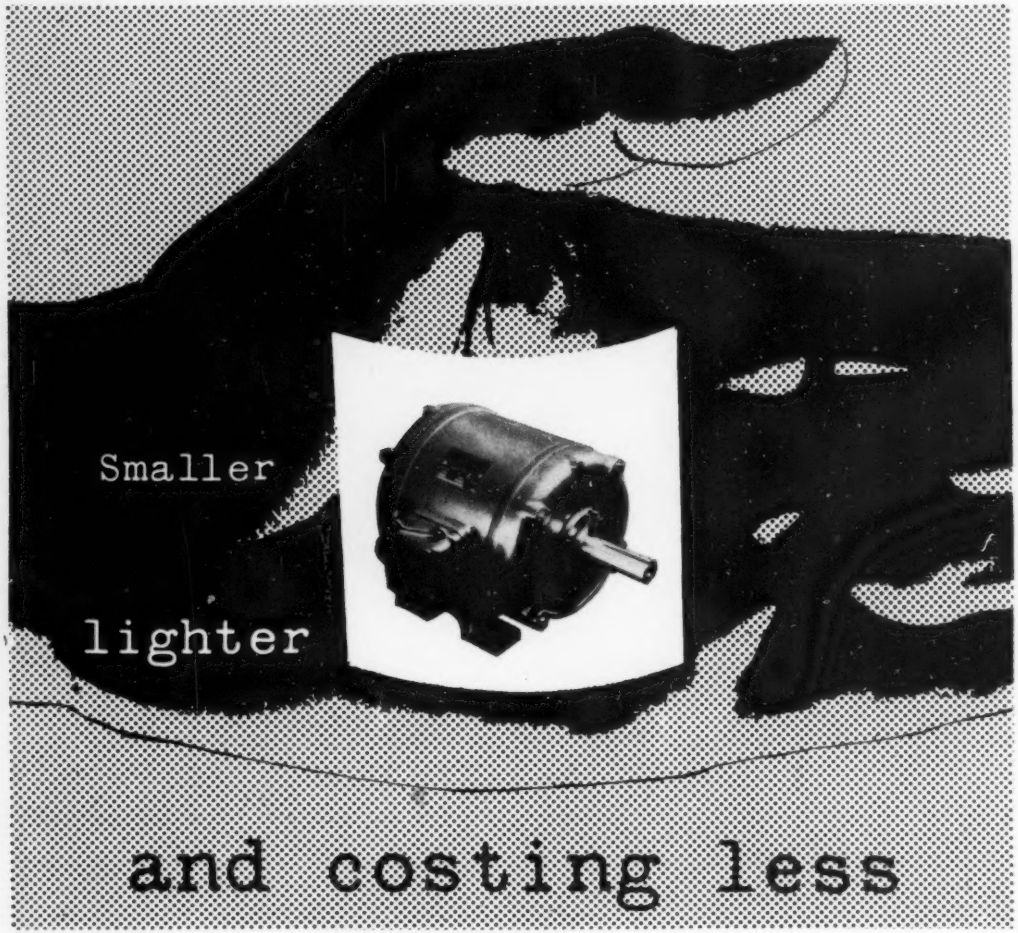

Series 5 motors are designed, electrically, to B.S.2613: 1957, and take full advantage of class E insulation. In frame size and mechanical details they comply with B.S.2960: 1958.

They are generally about one frame size smaller and 40 per cent lighter than previous standard motors of the same horsepower. This means they cost less.

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Although entirely new in design, these motors benefit in countless details of manufacture by the long experience of . . .

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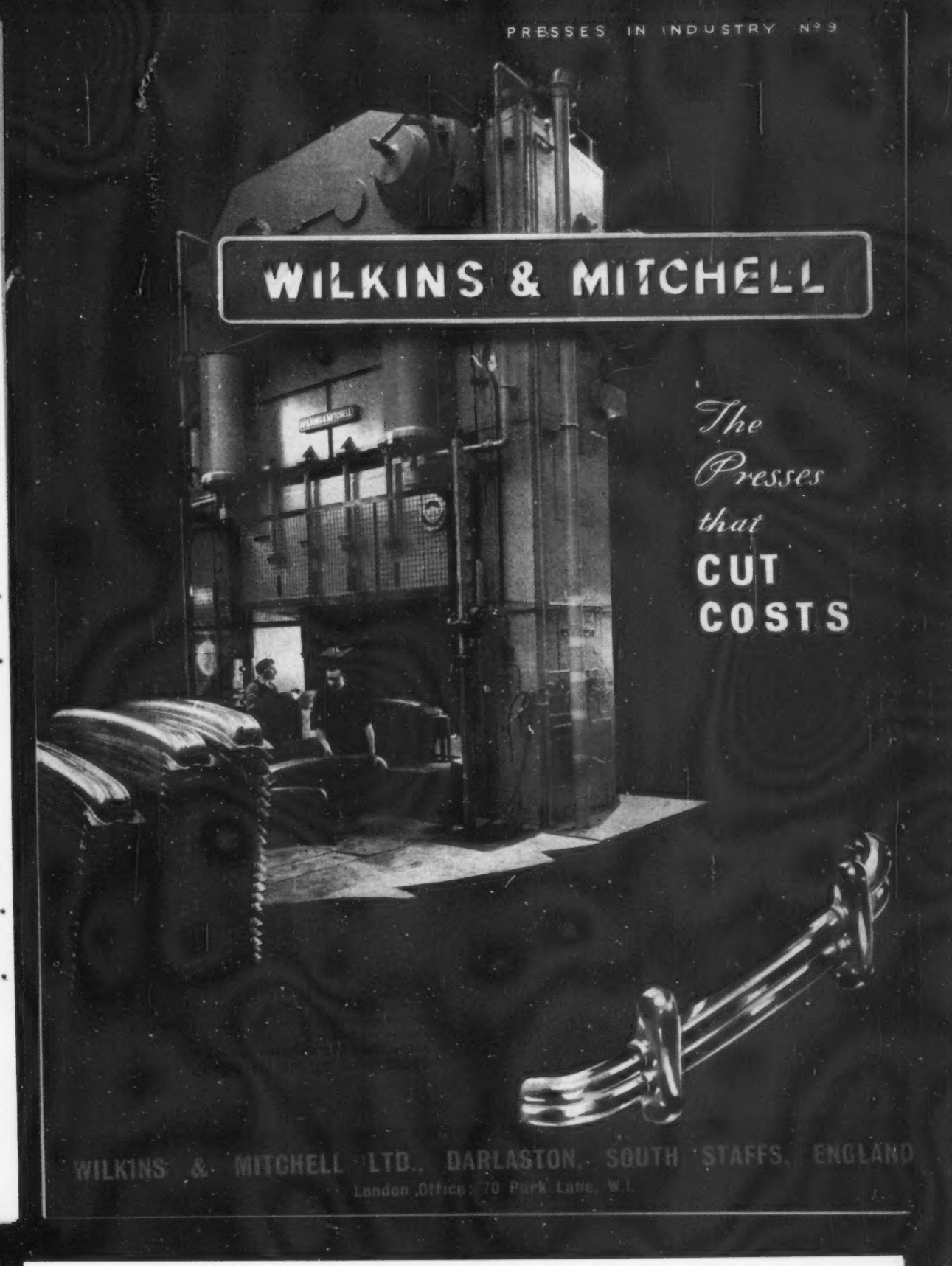

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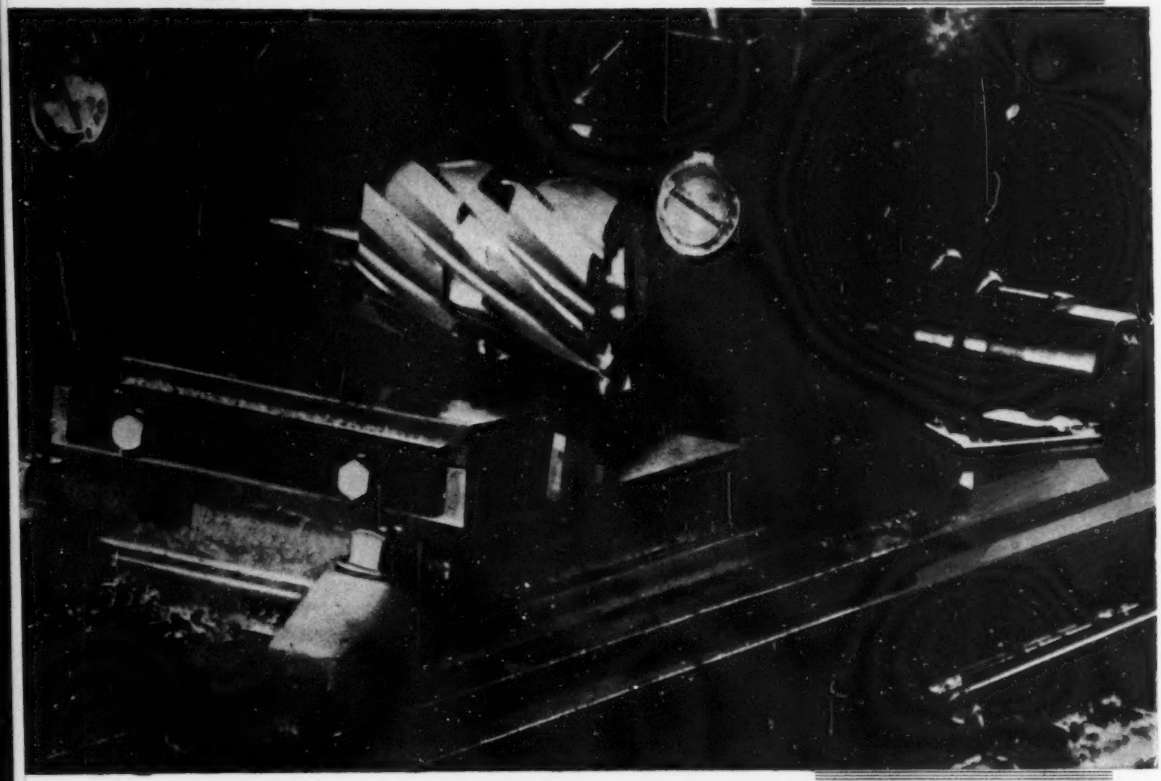


for greater gripping power

gripping right across face, side grip as well

total magnetic power unsurpassed

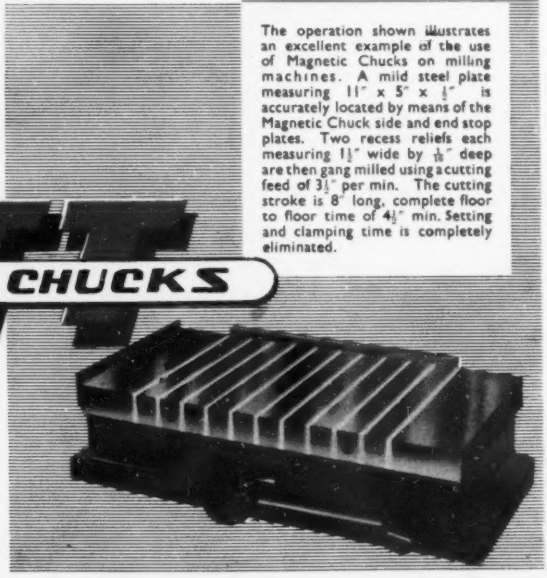
PRATT CHUCKS

light-durable-strong

end & side stop for easy, rapid setting

precision ground surface

The operation shown illustrates an excellent example of the use of Magnetic Chucks on milling machines. A mild steel plate measuring 11" x 5" x ½" is accurately located by means of the Magnetic Chuck side and end stop plates. Two recess reliefs each measuring 1½" wide by ⅛" deep are then gang milled using a cutting feed of 3½" per min. The cutting stroke is 8" long, complete floor to floor time of 4½" min. Setting and clamping time is completely eliminated.



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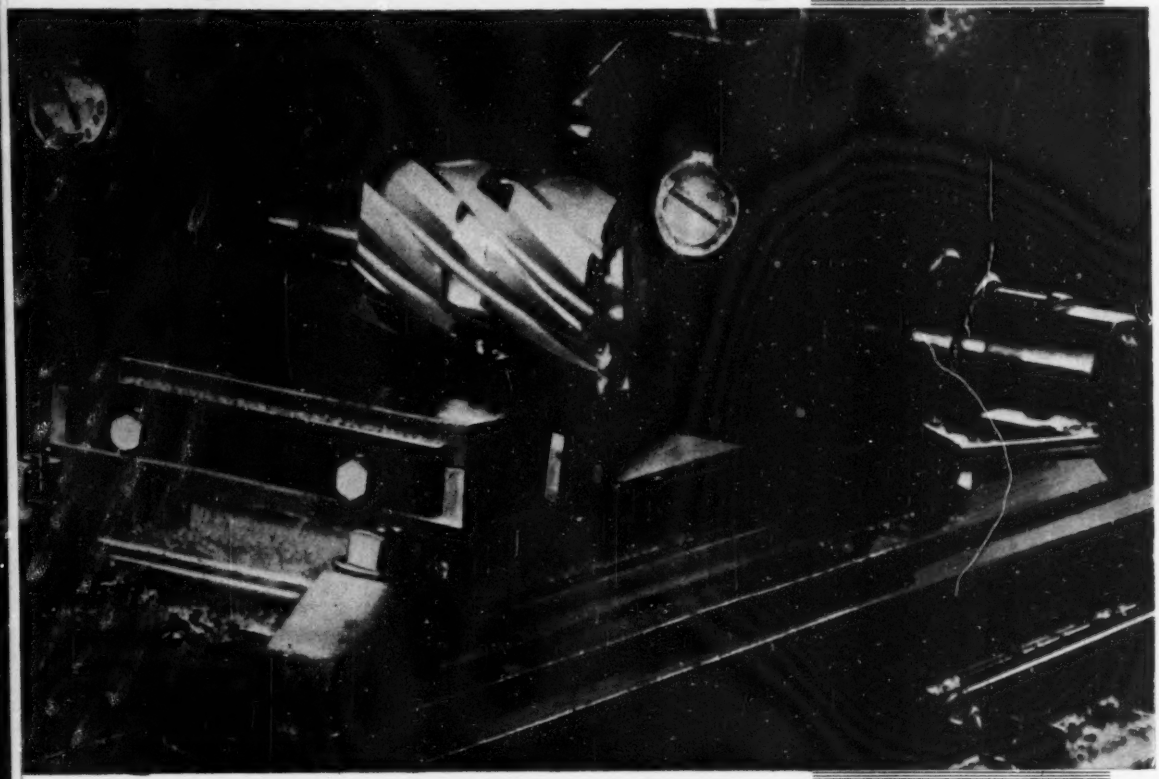
magnetic chucking



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gripping right across face, side grip as well

total magnetic power unsurpassed

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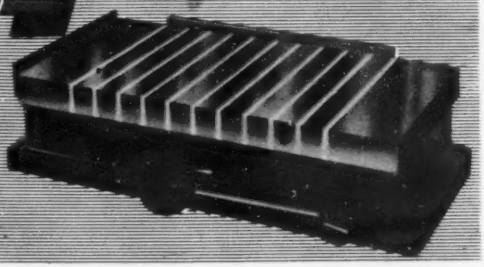
PRATT CHUCKS



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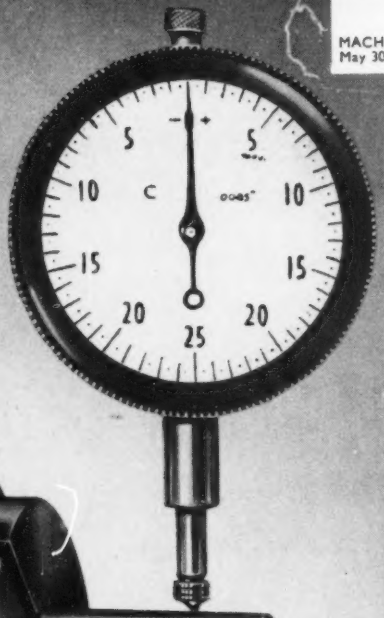

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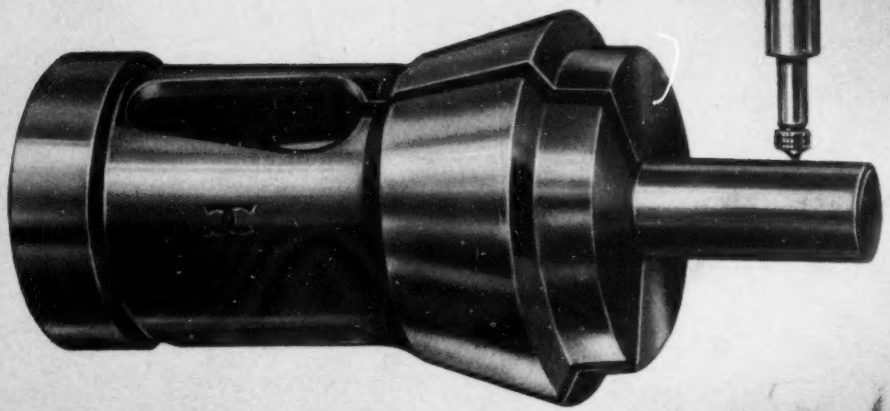

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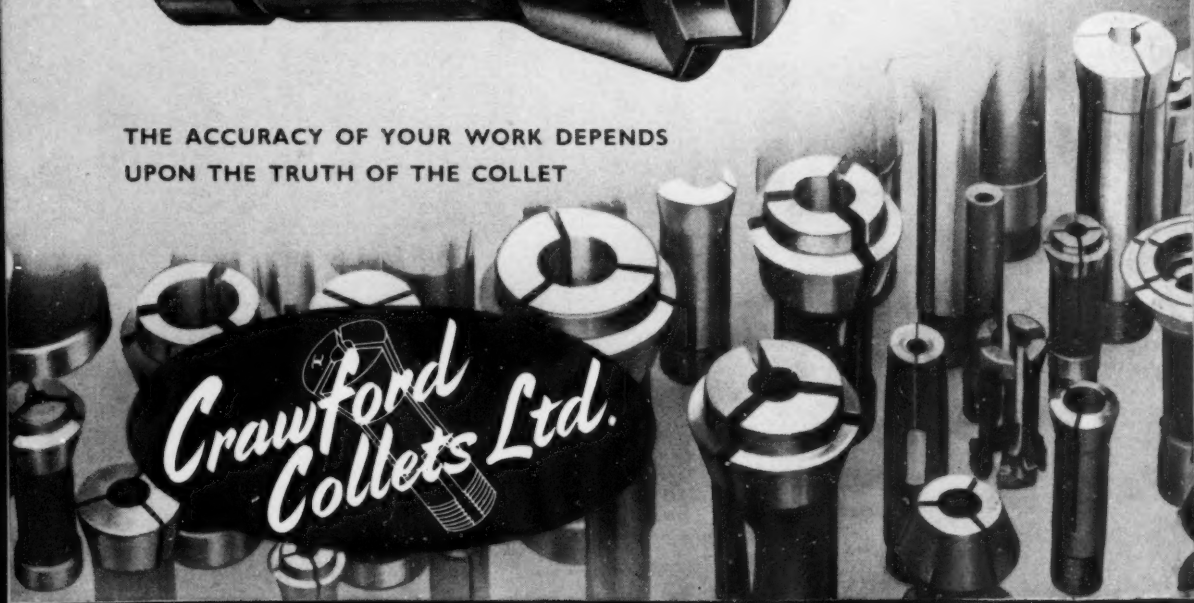

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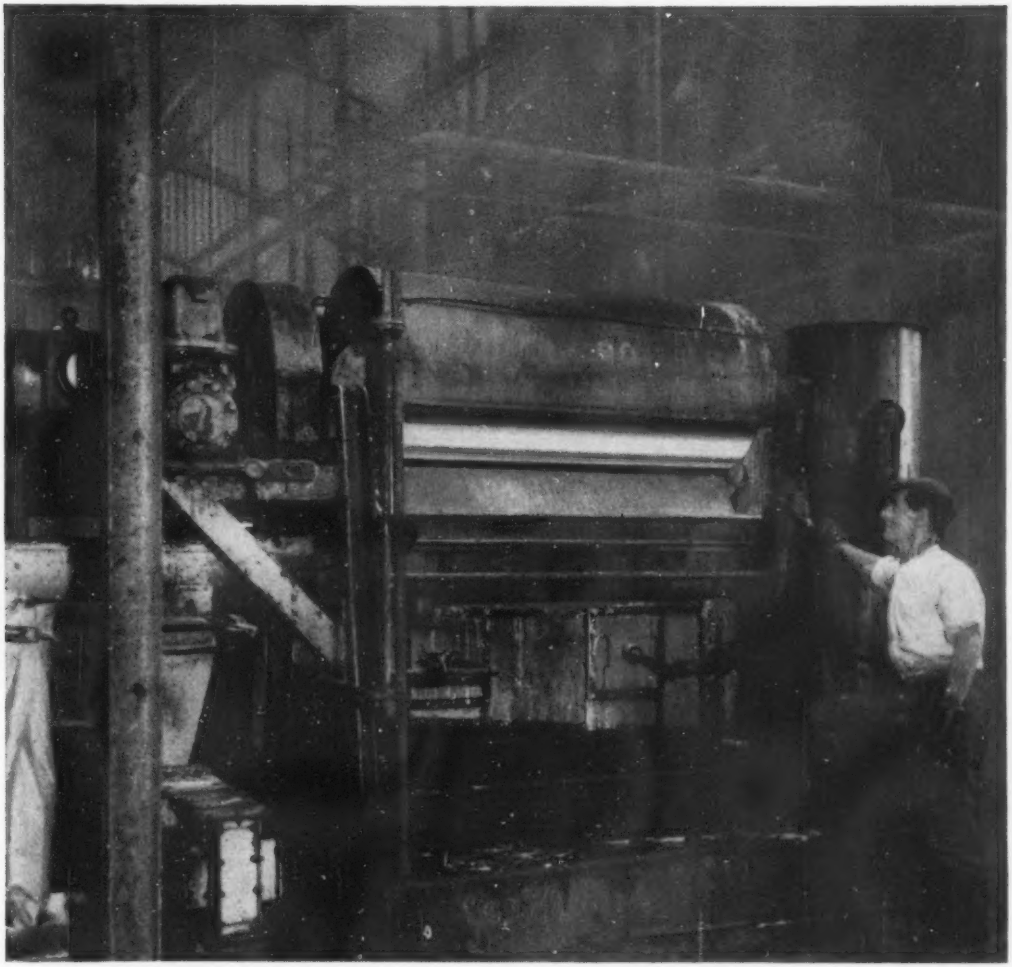

'Fescol'-ise and forget corrosion

The drums of this film dryer, used by the Ever Ready Company (Gt. Britain) Limited in the production of manganese sulphate monohydrate, have been deposited with hard chromium by Fescol.

The Fescol process of electro-deposition in chromium or nickel protects equipment against corrosion and provides a hard, long wearing, low friction surface. In the chemical industry such items as autoclaves, cooling coils, doctor blades, evaporator tubes, filters, heat exchange plates and mixers are among the items which have given improved service after 'Fescol'-ising.

For further information please write for publication No. M8

FESCOL

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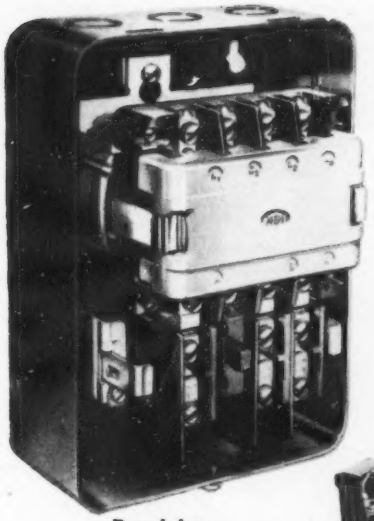


MEM *Autoline* STARTER

gives precision overload protection

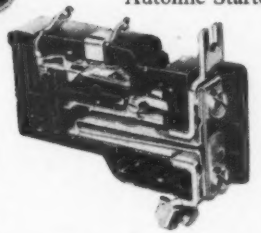
The MEM Autoline Starter meets today's needs exactly. It gives more accurate overload protection and so reduces hold-ups and loss of plant working time. This becomes increasingly important where each motor is a link in a long production chain.

The one basic starter is right for all motors from ¼ to 15 H.P. The only parts that need to match the duty are the heaters which operate the overload relays. By stocking a few basic starters and a range of heaters you can meet any starter requirement almost immediately.

Send for List No. 365 (U) describing the Autoline in detail. Access for wiring is particularly easy in the MEM Autoline Starter.

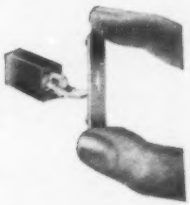
Precision Overload Protection

Each phase is protected by one of these thermal overload relays—an exclusive MEM design which operates with great accuracy. To protect any motor from ¼ to 15 H.P. you merely select the appropriate heaters. Over 40 heaters are available.



Silver contacts easy to replace

Contacts on the contactor units are solid silver for long life and freedom from trouble. They can be replaced in a moment without any tools whatever. Simply flick over a spring catch and lift off.

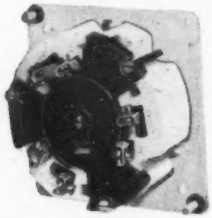


MEM ROTARY FUSED ISOLATOR—a tip-top job in every way

The MEM Rotary Fused Isolator is the finest isolator on the market. It's well designed, well made, beautifully finished.

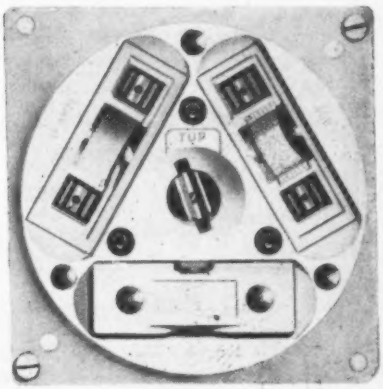
The switch is a slow-break AC type rated at 15 amps 500 volts. It will safely disconnect a stalled motor of 7½ H.P. taking six to eight times full load current. Fuses are 15 amp rewirable Kantark Major or alternatively standard H.R.C. fuse links to the dimensions of BS 88 1952 Appendix J.

Two patterns are available, for flush or surface mounting. Send for illustrated leaflet No. 346 (U).



Easy to install. *Wiring is especially easy with the MEM Rotary Fused Isolator. Heavy clamp terminals are provided and are clearly identified. For extra safety during maintenance an indicator at the rear shows whether the switch is on or off.*

Solid Silver contacts. *The slow-break AC switch is cam operated and includes solid silver contacts. Access to contacts for maintenance is easy.*



Renew fuses with complete safety. *Fuse inspection and renewal is completely safe with the MEM Rotary Fused Isolator because it is impossible to touch live metal.*

CEJ

THREADING TOOLS

CEJ PRODUCTS

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Chaser Dies
Screw Plug Gauges
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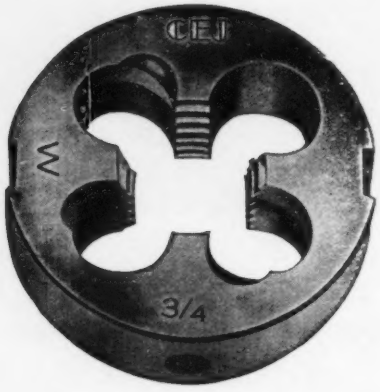
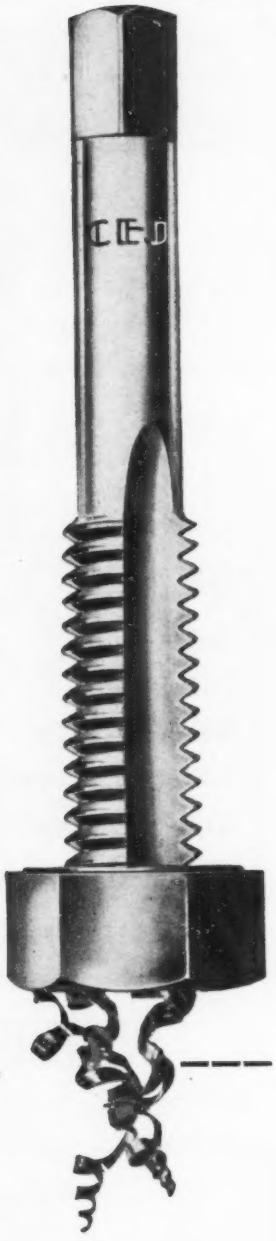
Vernier Height Gauges





C.E. JOHANSSON LTD.

PRECISION TOOLS AND INSTRUMENTS

A.I.D. AND A.P.I. APPROVED

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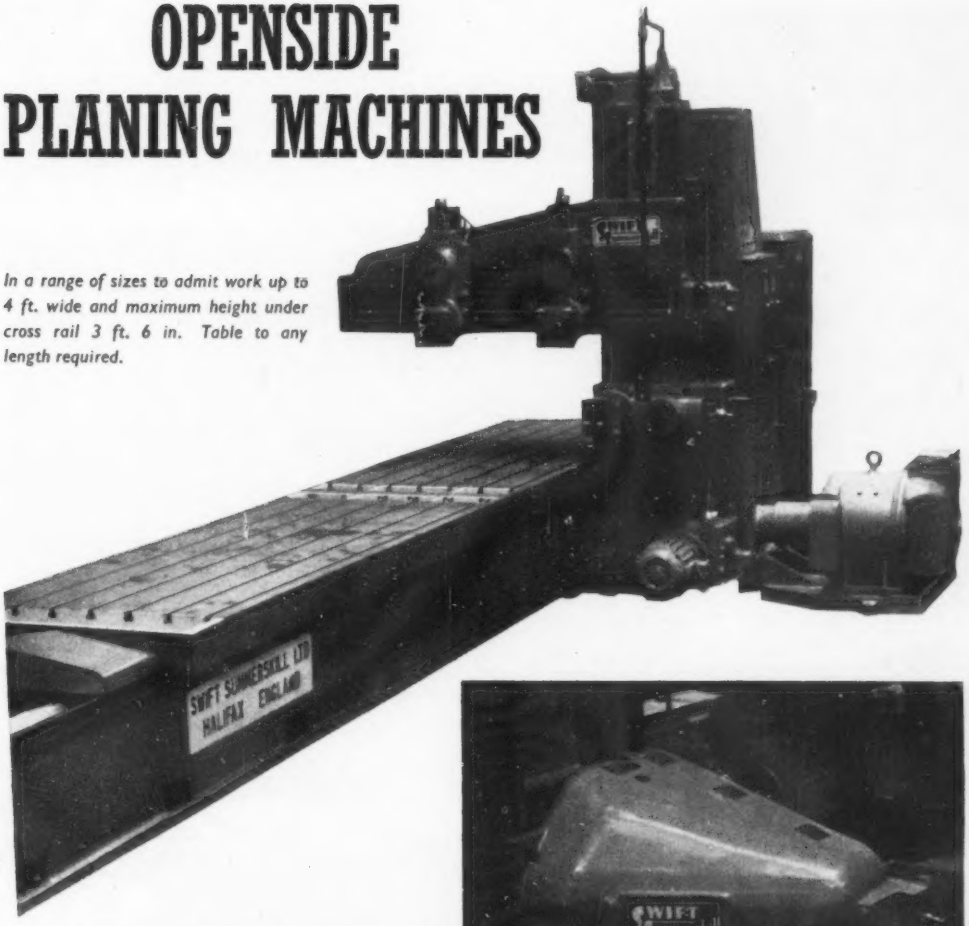
OPENSIDE PLANING MACHINES

In a range of sizes to admit work up to 4 ft. wide and maximum height under cross rail 3 ft. 6 in. Table to any length required.



The Swift-Summerskill all electric openside planer is of modern design that ensures the utmost rigidity and accuracy of alignment. Single helical gearing is employed for the table drive and a standard range of speeds from 25 to 200 ft. per min. is available. If required, alternative ranges down to 10-80 f.p.m. can be provided. The two smaller machines have feeds of 0·005 in. to 0·350 in. and the two larger planers feeds of 0·005 in. to 0·450 in. Write today for a catalogue describing these and other Swift-Summerskill Planing Machines.

This view of a Swift-Summerskill Openside Planer shows clearly the robust proportions of the buttress for the cross rail, which ensures rigidity.

Write today for further details

SWIFT-SUMMERSKILL LIMITED

CLAREMONT WORKS . HALIFAX . ENGLAND

Telephone : Halifax 3792 & 3793.

SWIFT Summerskill

the helical form makes all the difference to—

MSE

BORING TOOLS

- ★ Exceptionally long, useful tool life.
- ★ Regrinding confined to rake angle.
- ★ Constant clearance throughout.
- ★ Sizes for $\frac{1}{8}$" to $2\frac{11}{16}$" minimum bore.
- ★ Recessing, threading, facing and boring forms in all sizes.

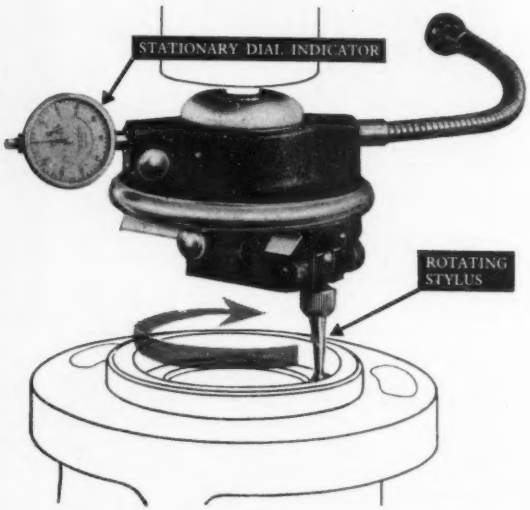
MSE **MACHINE SHOP EQUIPMENT LTD., Spenser St., London, S.W.1.** **Tel : Victoria 6086**

CENTRICATOR

Dial indicator centering and testing device

In the Centricator only the feeler is rotated—the dial indicator remains stationary. This leads to important advantages ; indicator readings are parallax free—both hands are free for positioning the work—misalignment of the work shows up instantly on the stationary indicator.

Centering accuracy of 0·0001" can be obtained with the Centricator, and the instrument can be used for either internal or external centering, for squareness testing and for true running tests.



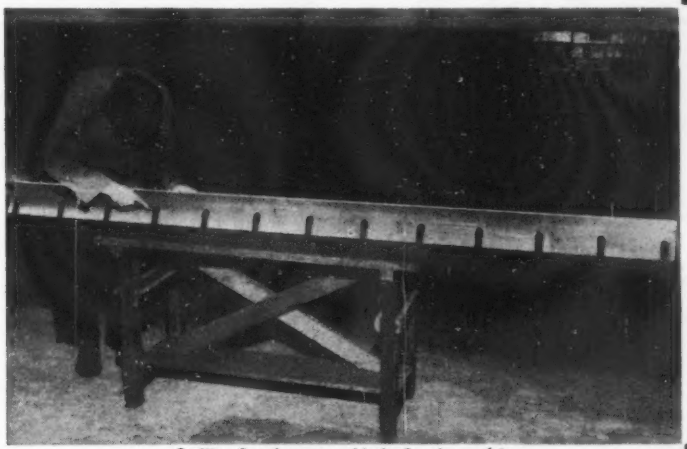
Write for further details to :

Available with $\frac{1}{2}$" dia. parallel shank and Nos. 1, 2 or 3 Morse Taper. With No. 1 M.T. a parallel adaptor bush of $\frac{3}{4}$in. O.D. is supplied.

MSE **MACHINE SHOP EQUIPMENT LTD., Spenser St., London, S.W.1.** **Tel : VICtoria 6086**

These blades like work

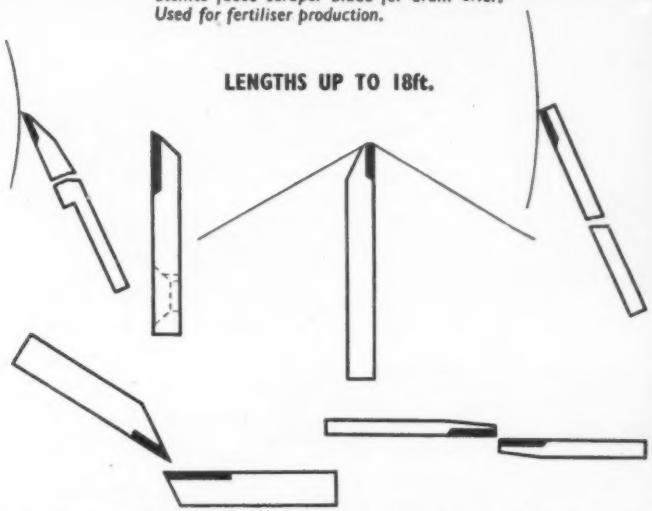
Stellite faced for destructive conditions



Stellite faced scraper blade for drum drier. Used for fertiliser production.

Blades or knives of mild or stainless steel with Stellite edges give a multiplication of steel blade life. Stellite resists wear, corrosion and heat and provides protection just where it is needed.

LENGTHS UP TO 18ft.



- DOCTOR BLADES
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PUBLICATION
B-35

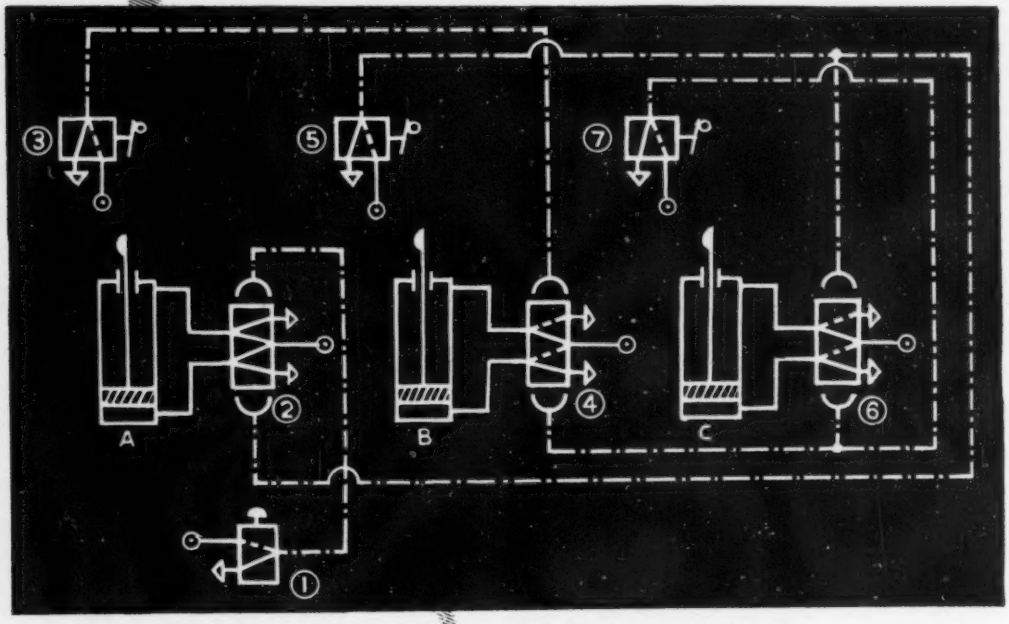
A.D. No. 239

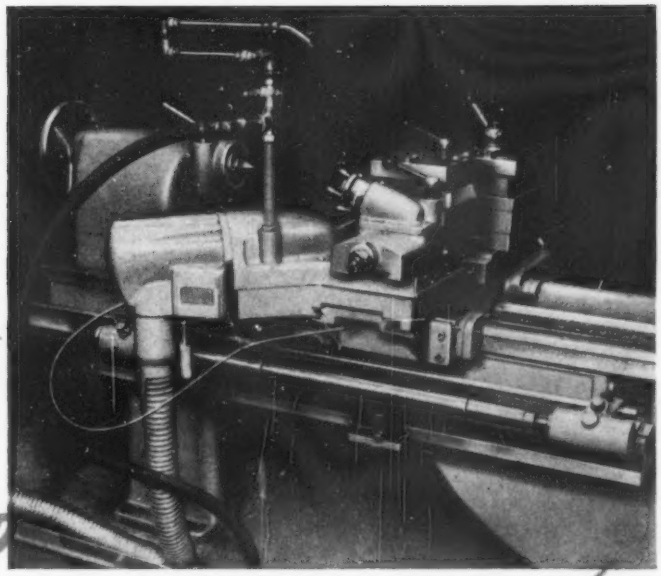
MARTONAIR TECHNICAL ADVISORY SERVICE—7

The circuit contains three cylinders, sequentially operated, and is a further example of the type of sequential control that can be obtained. The cycle shown is: A+, B+, C+ A—, B— C—. The cylinders do not necessarily operate in the same direction or in the same plane, and re-arrangement of the piping or components could provide many variations on this sequence.

Depression of the push-button of the three-port valve (1) reverses valve (2) and outstrokes cylinder (A). Roller-operated three-port valve (3) is tripped, reversing valve (4). Cylinder (B) outstrokes. Valve (5) is tripped, reversing valve (6) to outstroke cylinder (C). At the same time, valve (2) is returned to its original position to instroke cylinder (A).

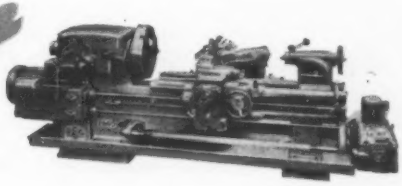
As cylinder (C) completes its stroke, valve (7) is tripped and supplies a signal to return valves (4) and (6) to their original positions and thus return or instroke cylinders (B) and (C). Flow regulators may be fitted to control the speeds of the cylinders, and if necessary, valves could be fitted to prevent a movement should an earlier movement not be completed. Thus, if it should be essential that (B) and (C) should not return to the position shown until (A) has completed a slow return, the air supply for valve (7) could be taken through a roller operated three-port valve fitted in such a position as to be depressed by the trip or cam on the piston rod of cylinder (A) in its inward position.





A SELF CONTAINED UNIT FOR .... CLOSE LIMIT COPYING TO NEW AND EXISTING CENTRE LATHES

THE HEPWORTH *Hydraulic* COPYING ATTACHMENT



- DOES NOT IMPEDE THE NORMAL USE OF THE LATHE IN ANY WAY

NOTE THESE IMPORTANT FEATURES

- Machining times on complicated shapes and batch work greatly reduced.
- Fine tapers and radii readily copied and close tolerances maintained.
- Round models or flat templates can be used as masters.
- The attachment is fitted to the rear of the lathe and does not interfere with the front tool post in any way.
- Can be used for turning, boring and facing operations.

The above illustrations show the H.I.C. attachment fitted to a Dean, Smith & Grace 21in. Swing Lathe

OUR EXPERIENCE IS AT YOUR SERVICE

THE HEPWORTH IRON CO. (ENG) LTD., HAZLEHEAD NR. SHEFFIELD

HIC LTD ENGINEERING

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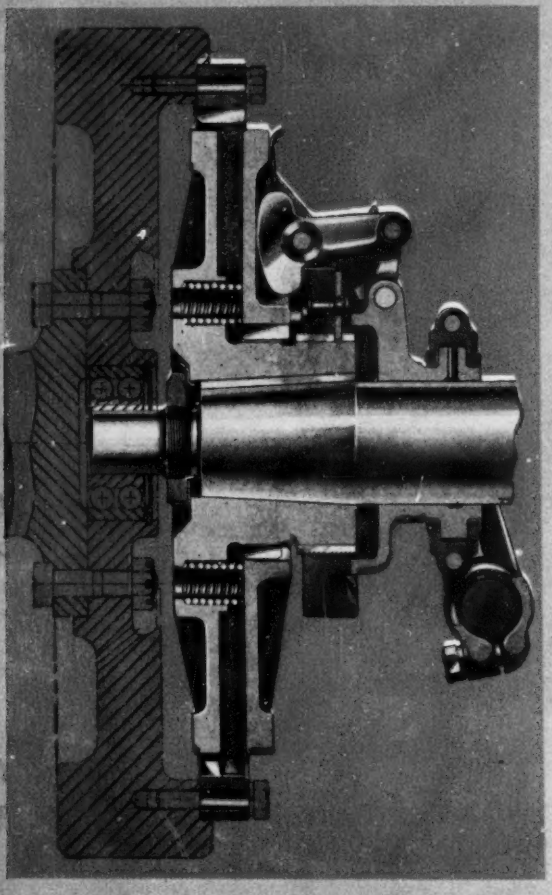


The illustration shows the Perkins 'L.4' diesel engine, with Rockford 'over-centre' clutch, driving through a Cyril Norris reduction gear, giving a low-speed take-off of value in many industries.

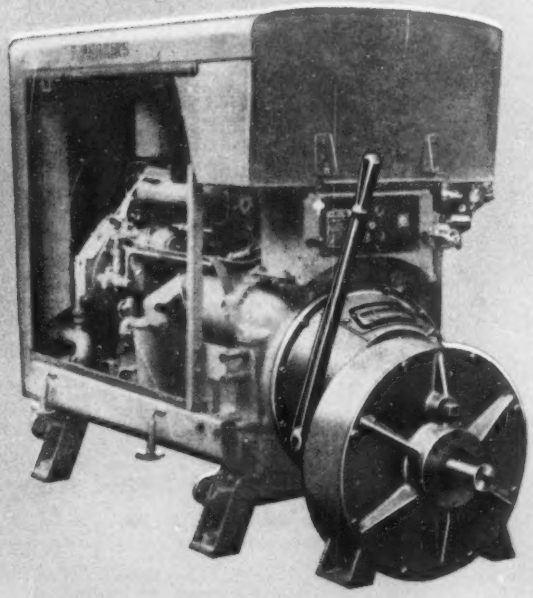
BORG & BECK CLUTCHES,
used extensively on cars and commercial vehicles, are made in a wide range of sizes. Particulars of these and Rockford clutches on application.

BORG & BECK COMPANY LTD.
LEAMINGTON SPA, WARWICKSHIRE
Regd. Trade Mark: BORG & BECK

ROCKFORD

High-duty Clutches & Power Take-offs

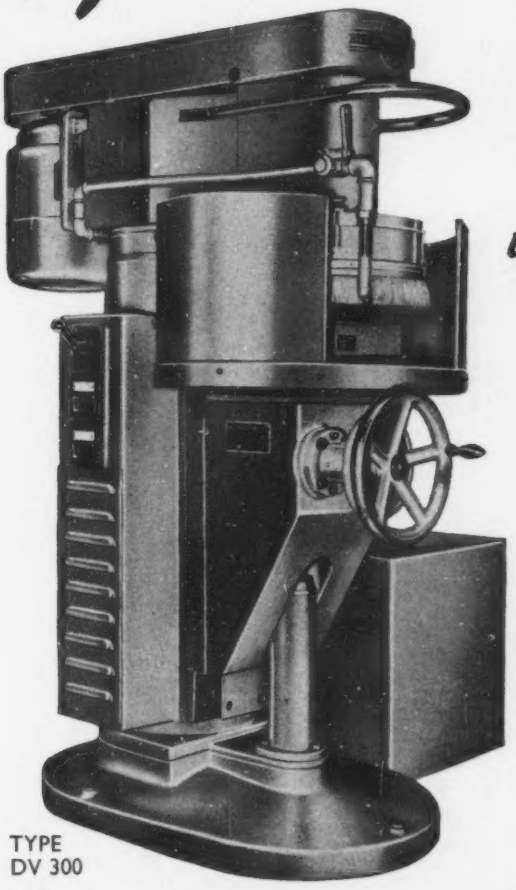
Rockford 'over-centre' clutches are expressly designed for use in installations where it may be desirable to run for long periods with the clutch either engaged or disengaged. Their 'over-centre' toggle action is such that there is no running thrust while the clutch is in, or while it is out. The only thrust exerted is during the momentary periods of operation. A wide range of sizes is made, from 5½-in. up to heavy twin-plate clutches, and complete power take-offs are also supplied, comprising housings with the clutch installed.



High Speed STOCK REMOVAL

DISKUS

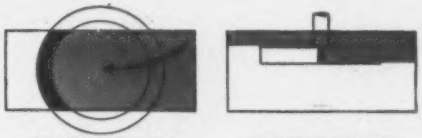
SWIVEL HEAD SURFACE GRINDER



TYPE
DV 300

ENTIRE WORKPIECE SURFACE GROUND IN ONE WORKPASS

The superior stock removal capacity of the segmental grinding wheel shortens grinding time to a fraction of that taken by peripheral grinding owing to the small area of contact with the workpiece.



ONE TRAVERSE WITH DISKUS GRINDER

MANY TRAVERSES WITH PERIPHERAL GRINDING

Balanced swivel arm, mounted on heavy duty anti-friction bearings fitted to amply dimensioned column, ensures smooth and easy movement.

BRIEF SPECIFICATION—TYPE DV 300

Diameter of Segmental grinding wheel 12"
Chucking surface of work table 16" x 8"
Vertical adjustment handwheel graduated in ·0002"

Low Cost—Early Delivery

This machine is only one of the many different models of the standard and special segmental wheel grinders made by the Diskus Company.

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ROCKWELL
MACHINE TOOL CO. LTD

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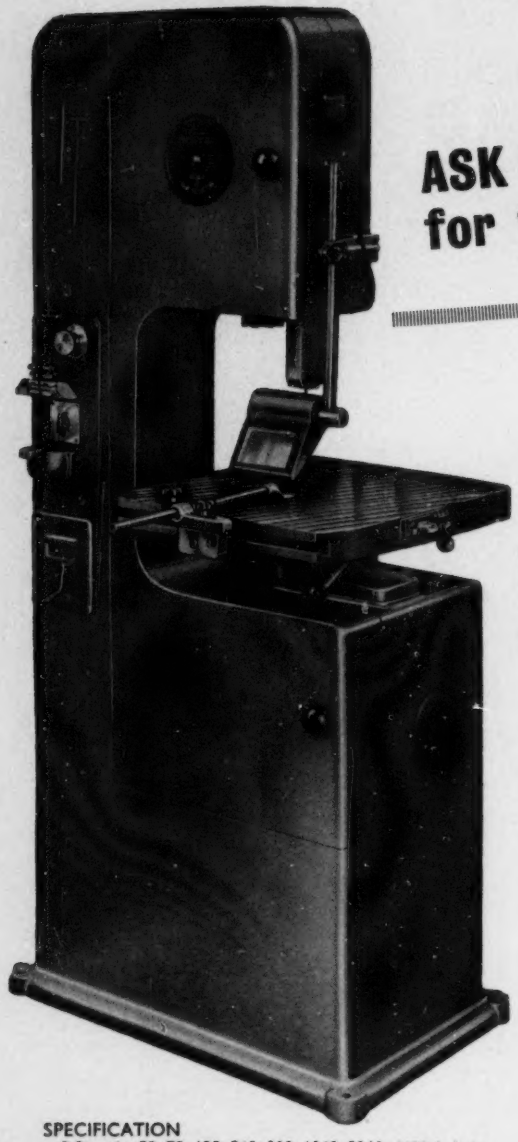
DV 300



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ESSEX

12" BANDSAW

ONLY THE ESSEX 12" BANDSAW HAS ALL THESE ADVANCE FEATURES

BUTT WELDING INSTEAD OF BRAZING
gives stronger, quicker saw joint, making an unskilled operation of joining saw bands

BUILT-IN WELDING FLASH GRINDER

WIDE SPEED RANGE suitable for all materials

DIRECT READING SAW and SPEED SELECTOR

PRECISION SPIRIT LEVEL TABLE TILT INDICATORS

COMBINED LIGHT and MAGNIFYING LENS UNIT

GROOVED TABLE TOP aids flush work location

SPECIFICATION
8 Speeds, 50, 75, 125, 260, 900, 1360, 2260, 4680 ft./min. Table Size, 18" x 22" · Table Tilt, 15° in four directions Max. Height of Work, 8" · Throat Depth, 12" · Range of Saw Widths, 1/16" to 5/8" · Wheel Diameter, 13" 1 H.P. Motor.

STANDARD EQUIPMENT
Built-in chip blower unit · Direct reading Saw and Speed selector · All necessary spanners and oil gun Magno-lite Unit · Butt Welder.

SOLE AGENTS

ROCKWELL MACHINE TOOL CO. LTD.

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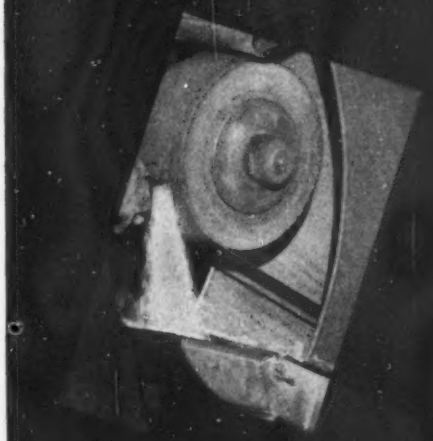
Come back again . . .

. . . to a re-assessment of Resin Bonded Belts for Metalworking now that Behr-Manning have produced one that is so much improved it outdates all previous comparisons! Measure these improved resin bonded belts on their rate of cut and length of life—that is your basis of cost *and of your profit.*

Because improved Behr-Manning Resinall Metalite Belts have a double bond of thermo-setting resins immune to grinding heat, rigidly holding the abrasive grains to their work, you will find they show overall economies on many jobs—particularly high production, extremely rugged dry grinding. Try them and see for yourself—see your Norton Representative or write to us at Welwyn Garden City.

★BEHR-MANNING

Resin Bonded Belts will save you money



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COATED ABRASIVES DIVISION, WELWYN GARDEN CITY, HERTS. Telephone: WELWYN GARDEN 4561 (10 lines)

NORTON *and* BEHR-MANNING *factories also in Argentina, Australia, Brazil, Canada, France, Germany, Italy, Northern Ireland, South Africa, and U.S.A.*

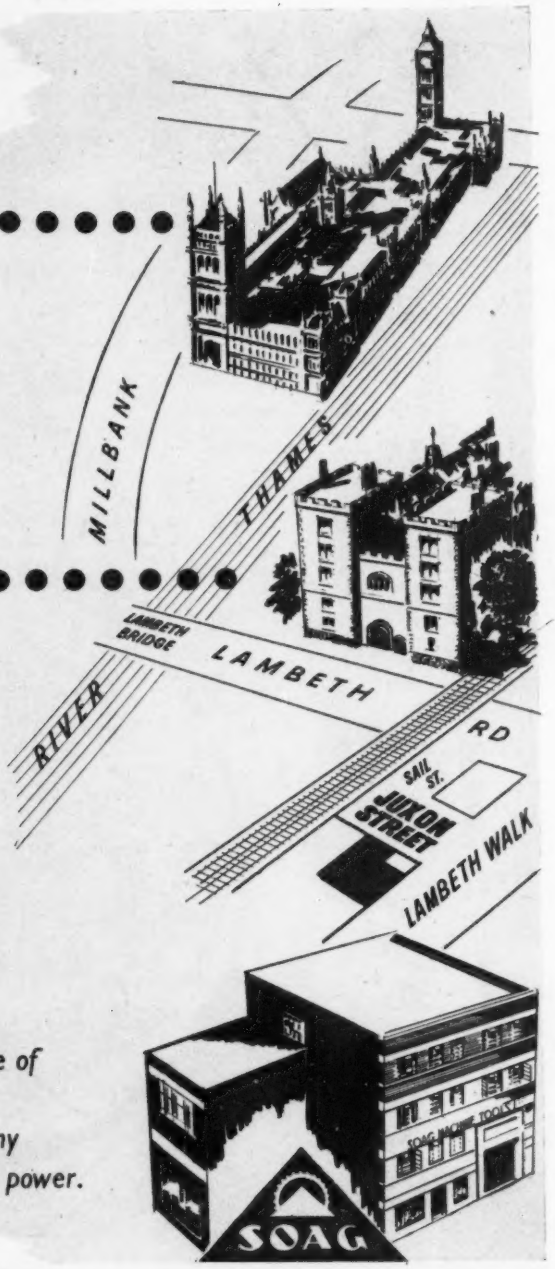
NGW/CM/137

In town and near Westminster ?

...it's only a short step to Lambeth Palace

...and a little further to our showrooms at Juxon St., and Battersea...

we cordially invite you to view our extensive range of highly productive machine tools, many continuously under power.



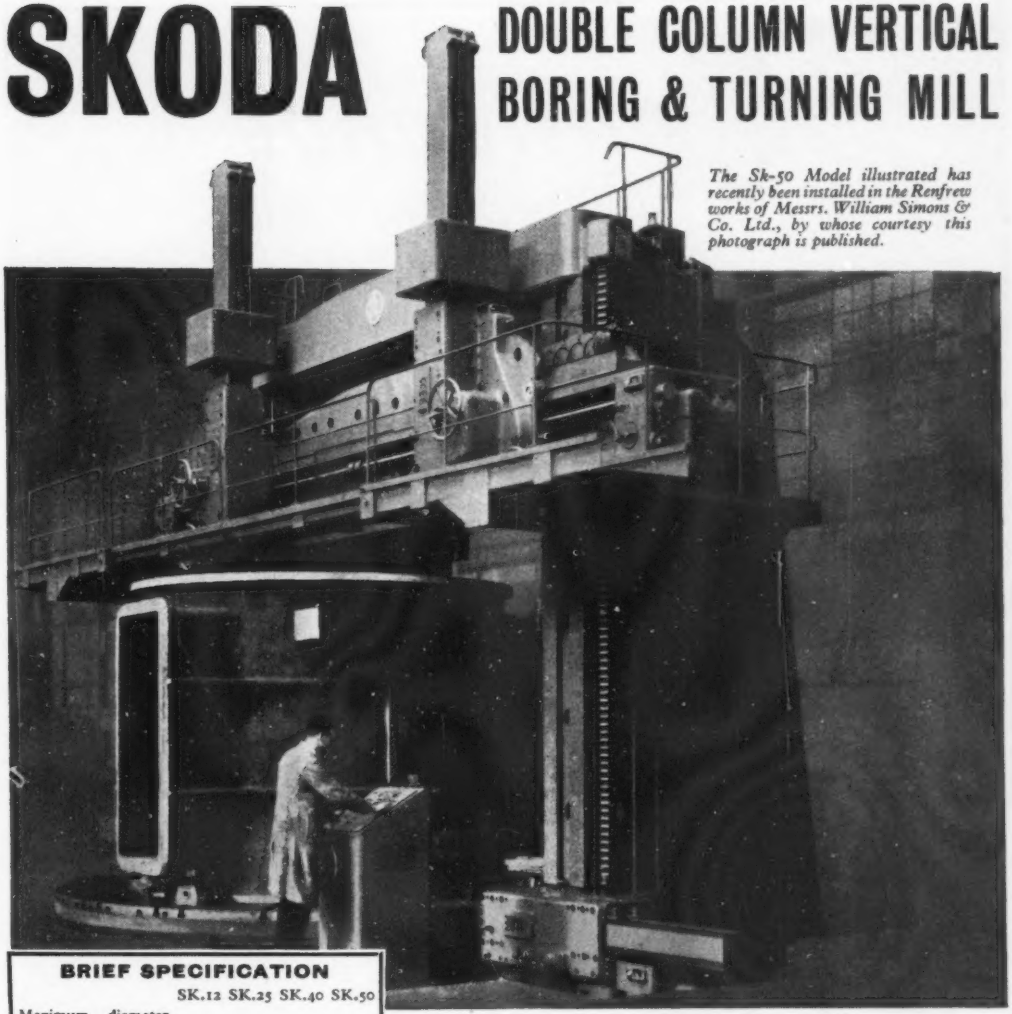
SOAG MACHINE TOOLS LTD

JUXON STREET · LAMBETH · LONDON S.E.11

PHONE: RELIANCE 7201 GRAMS: SOTOOLSAG, LONDON

SKODA

DOUBLE COLUMN VERTICAL BORING & TURNING MILL



The Sk-50 Model illustrated has recently been installed in the Renfrew works of Messrs. William Simons & Co. Ltd., by whose courtesy this photograph is published.

BRIEF SPECIFICATION

	SK.12	SK.25	SK.40	SK.50
Maximum diameter of turning with Side Arm - - - - - -	4′ 1″	8′ 2½″	13′ 1″	16′ 5″
Maximum diameter of turning with Side Arm lowered below Clamping Plate - -	4′ 5″	8′ 6½″	13′ 9″	17′ 1″
Diameter of Table. -	3′ 10″	7′ 10½″	12′ 4″	15′ 7″

Intended for the heaviest turning operations, these machines will satisfy the most exacting demands of production for high output. Outstanding features are:—

- INFINITE SPEED VARIATION
- RELEASING AND CLAMPING OF CROSS RAIL OPERATED BY PUSH-BUTTON CONTROL
- CONTROL OF ENTIRE MACHINE BY PUSH-BUTTONS FROM CARRIAGES AS WELL AS REMOTELY FROM CONTROL-DESK
- GEARS MANUFACTURED OF SPECIAL STEEL, HARDENED AND, WHERE NECESSARY, GROUND

Selson MACHINE TOOLS

SOLE AGENTS

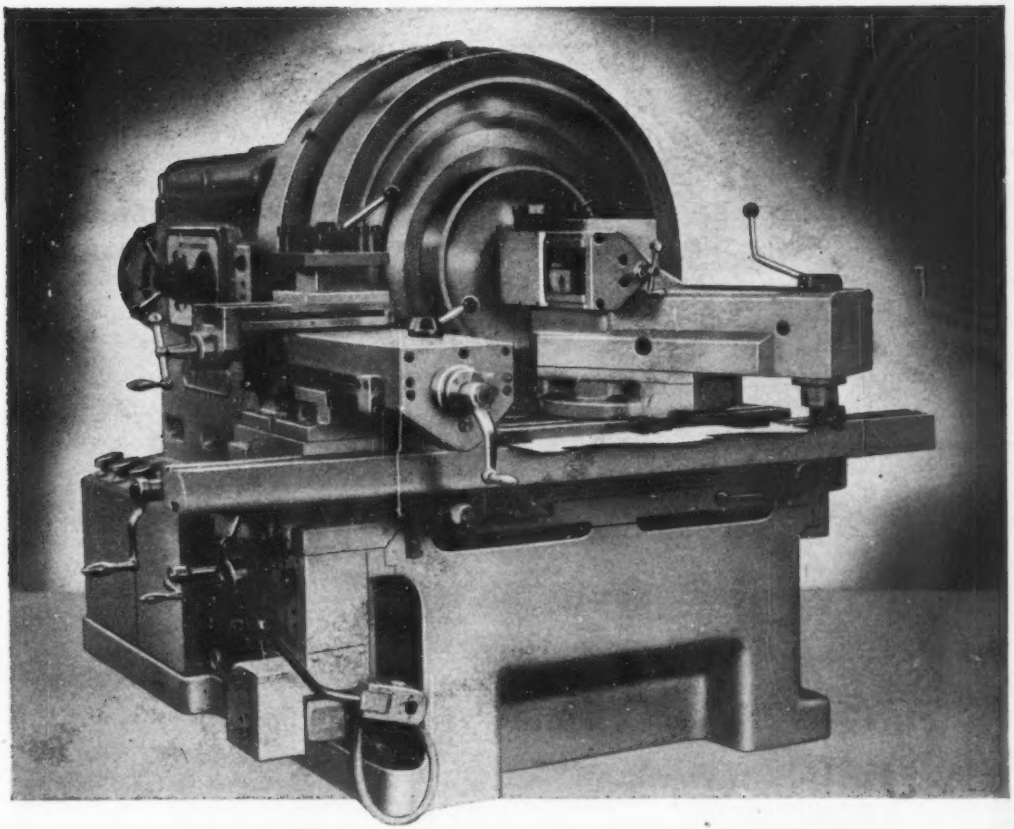
THE SELSON MACHINE TOOL CO. LTD

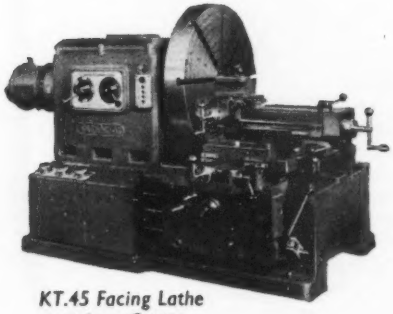
41-45 Minerva Road, North Acton, London, N.W.10

Telephone: Elgar 4000 (10 lines) *Telegrams: Selsomachi, London, NW10*

The 600 GROUP

H★





KT.45 Facing Lathe without Copier

RAVENSBURG KT.45 FACING LATHE

with hydraulic copier and additional front toolpost, for turbine discs, moulds, etc.

Max. turning diameter	42"
Speed range	8.4 - 380 r.p.m.
Gap width in front of faceplate	17¾"
Max. weight of workpiece	16 cwts.
Longitudinal adjustment of copying tool	6⅞"
Adjustment parallel with centre line at an angle of 30° to copying head	6"
Max. cutting force	3520 lbs.
Nett weight of machine	5 tons

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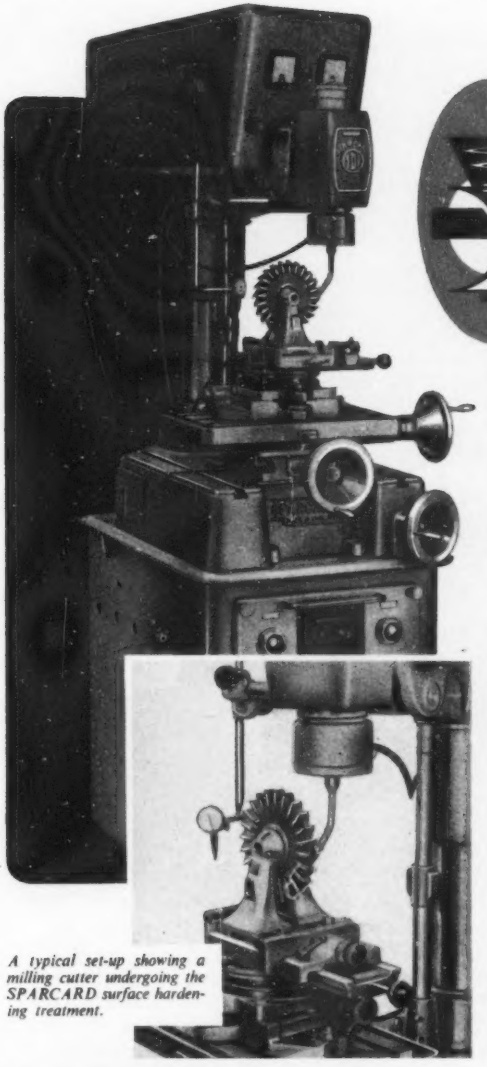
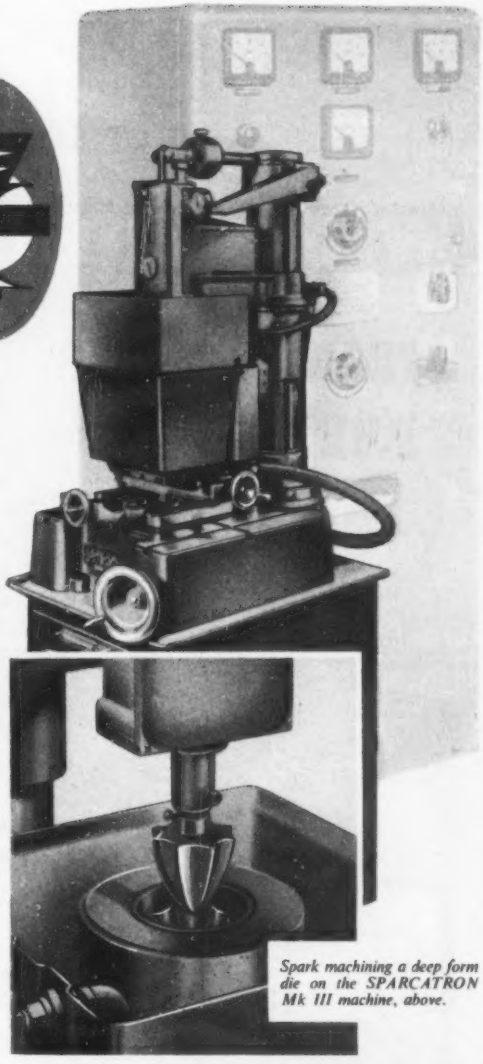


A typical set-up showing a milling cutter undergoing the SPARCARD surface hardening treatment.



Spark machining a deep form die on the SPARCATRON Mk III machine, above.

SPARCARD

surface hardening process

Specially developed as a result of spark machining research, the SPARCARD machine provides certain high speed steel tools such as milling cutters, with hard wear resistant surfaces, and prolongs life between regrinds.

(We have installed equipment for treating cutters by the SPARCARD process to customers' demand).

SPARCATRON

spark erosion machining

For spark machining and reconditioning press tools and dies and wire drawing and extrusion dies in cemented carbides and hardened steels. There are extensive applications for "cutting," reconditioning or altering flat and tangential form tools and similar components.

Manufactured by Impregnated Diamond Products Ltd.

BURTON GRIFFITHS

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BURTON GRIFFITHS & CO LTD · KITTS GREEN · BIRMINGHAM 33

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SP6

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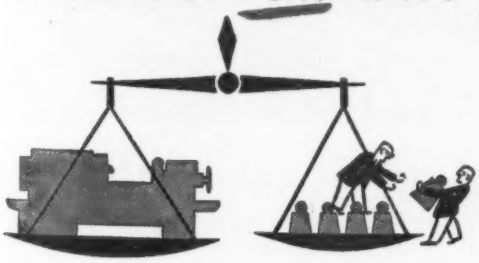
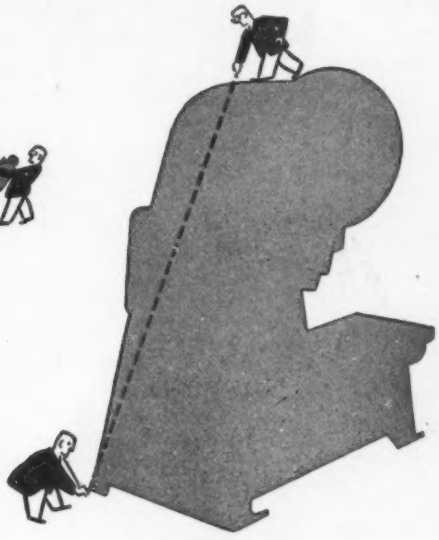


BY WEIGHT?

BY VOLUME?

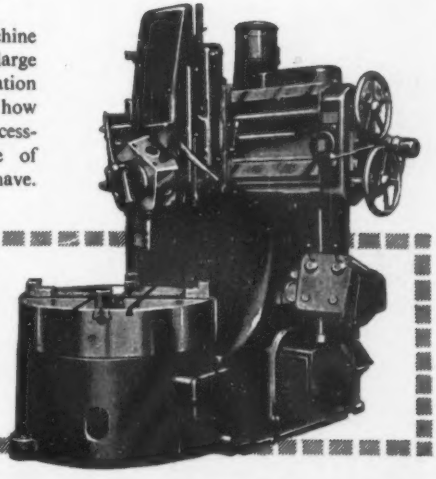


OR BY HONEST-TO-GOODNESS FITNESS FOR PURPOSE?

Whichever method you favour you'll find there is no better value in the world, to-day, than Webster and Bennett Boring Mills.

Because the range is restricted to variations of a single basic type, production resources are rationalised, resulting in low manufacturing costs and therefore low prices.

You can find evidence of their popularity in most machine shops concerned with the boring and turning of medium to large castings and forgings, and if you *can* conduct a short investigation on your own account, ask how long they have used them; how they like the centralised hydraulic control system; or the accessibility of the unit-constructed sub-assemblies and ease of servicing. You'll get the answers we would like you to have.



This is a standard Webster and Bennett Boring and Turning Mill with 48" dia. chuck, admitting jobs of 53" dia., with 35" under the turret and 24" under the cross-slide.
Machines can be supplied with Screwcutting, Taper Turning, or Spherical Turning Attachments, or with built-in Electronic Profile Turning Equipment.

WEBSTER & BENNETT LTD., COVENTRY, ENGLAND

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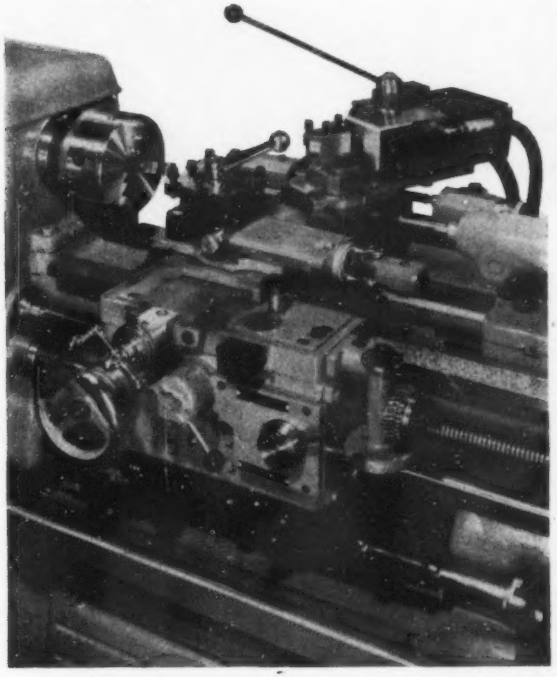
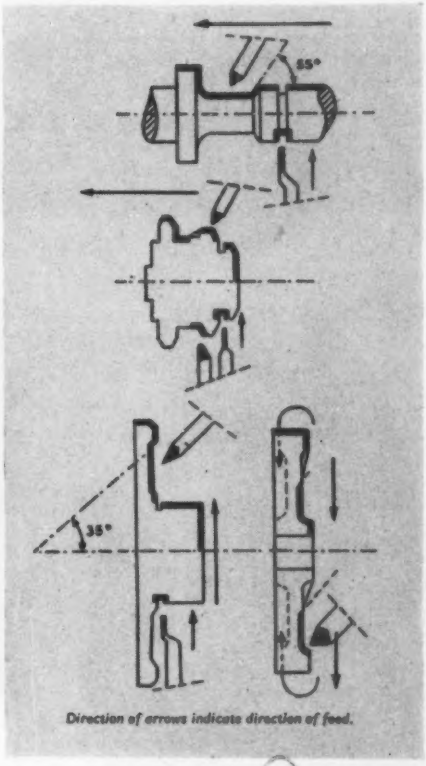
When answering advertisements kindly mention MACHINERY.

When answering advertisements kindly mention MACHINERY.

for versatility in Copy Turning





Direction of arrows indicate direction of feed.

The HEB type HN and AC lathes with built-in hydraulic copying units may be employed on either longitudinal or transversal copying. The square turret may be used in conjunction with the copying unit or for normal lathe work. The position of the copying unit and its angle can be set to suit the size or form to be machined as shown in the diagram of work examples above. Maximum piston stroke is 3in. for the AC machine and 3½in. on the HN type. Copying length is 16½in. and 39in. respectively and maximum swing over cross slide from 5⅜in. on the AC up to 12½in. on the largest HN type. These lathes can be used for all normal S.S. & S.C. lathe work and can be supplied with or without screwcutting equipment.

Sales & Service for . . . **DRUMMOND-ASQUITH** . . . the British Isles

DRUMMOND-ASQUITH (SALES) LTD., KING EDWARD HOUSE, NEW ST., BIRMINGHAM

'Phone: Midland 3431 (7 lines) 'Grams: Maxishape, B'ham. Also at LONDON: Phone: Trafalgar 7224 (5 lines) and GLASGOW: 'Phone: Central 0922

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Abstracts of Principal Articles

The Production of Components for Portable Electric Tools .....P. 1256

At the factory of Wolf Electric Tools, Ltd., Pioneer Works, Hanger Lane, London, W.5, Pfauter, Maxicut, Sykes and Klingelnberg machines are employed in a section where more than 100 different types of gears are produced for the firm's wide range of power tools. The gears are hardened and tempered on three conveyorized lines, incorporating induction heating equipment, which converge to a central delivery point. In the general machine shop, several set-ups incorporating air-operated equipment are employed, including one on a No. 1 Archdale horizontal milling machine arranged for cutting flats on cotterpins on a fully-automatic cycle. Other set-ups incorporate Wolf electric drills. On a Drebomat 2-spindle fine-borer, a portable pneumatic drill is applied automatically to perform a supplementary drilling operation. (MACHINERY, 92—30/5/58.)

Production of Thin Metal Parts by Photo-etching .....P. 1277

Photo-etching is a convenient means of producing parts of intricate shape from thin sheet metal, particularly for small batches, or in connection with development work. Fairly close limits can be maintained, and the components are free from burrs and strains. The procedure followed by a company in the U.S.A. is here briefly described, and some typical parts are illustrated. Particular reference is made to beryllium copper springs which may require numerous modifications before a satisfactory design is finalized. (MACHINERY, 92—30/5/58.)

Ferranti Die Castings for Electricity Meters .....P. 1287

At the Hollinwood works of Ferranti, Ltd., a light-alloy die casting foundry has recently been established for the large-scale production of components for the company's well-known electricity meters. A No. 2G and a No. 1½G Reed-Prentice machine, built by Alfred Herbert, Ltd., are installed, and metal is supplied by two Birlec-Tama induction-type bale-out furnaces. In connection with the wide variety of components that is now being made, special attention is drawn to a 2-impression die of interesting design which is employed for producing brake magnet assemblies incorporating Alcomax permanent magnet inserts. Reference is also made to a single-impression die for a gear drum component of special form with a cast-in spindle, and to tools for producing meter frames and case backs. (MACHINERY, 92—30/5/58.)

Pressure Die Casting of Zinc in the Necchi Foundry .....P. 1292

Particulars are given, in this third article, of the arrangements for the casting of zinc alloys in the new Necchi pressure die casting foundry. Three water-hydraulic Triulzi machines are installed and a die for casting four different sewing machine components is first described. Other interesting zinc castings are illustrated, and details are also included of an Idra hot-chamber machine and one of the dies employed on it. (MACHINERY 92—30/5/58.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

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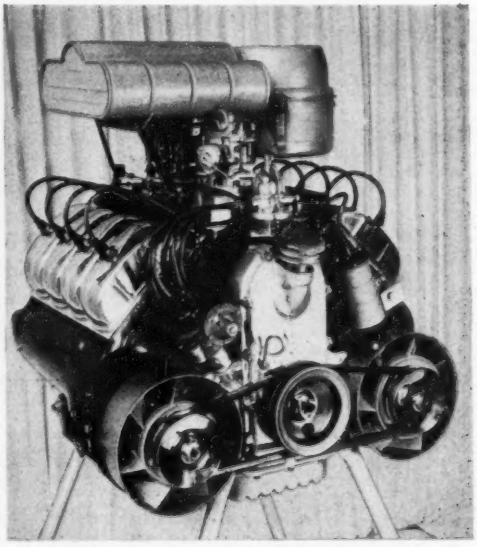
The 8-cylinder, rear-mounted, air-cooled engine for the latest Tatra 603 streamlined limousine which is now being built in Czechoslavakia. It has a capacity of 2,545 c.c., a compression ratio of 6·5 to 1, and an output of 100 h.p. at 5,000 r.p.m. The weight of the engine is little more than 3 cwt., and the car has a maximum speed of 106 m.p.h.



Performance of Synthetic Diamond

With increasingly exacting demands as regards accuracy and surface finish for a wide variety of components produced by many different branches of the metal working industries, the various grinding and lapping processes continue to assume greater importance. Obviously the success of such processes, particularly where the highest degrees of refinement are demanded, depends largely on the equipment available and the procedure followed. At the same time, the quality and characteristics of the abrasives employed, and the manner in which they are applied, necessarily play an important part. In this respect, industry is well served. Abrasives of fully-established types are available to meet a diversity of requirements, and high standards are maintained in their preparation and processing, for example into grinding wheels and honing stones. Despite various developments in this field, however, diamond, by reason of its extreme hardness, remains supreme for certain purposes, and its industrial importance tends to increase, particularly as a result of the wider adoption of such materials as cemented carbides, which offer exceptional resistance to abrasion. It is likely, too, that diamond may find greater application in the future for various production operations where the control of work size is of particular importance.

Because of the significance of diamond in metal working, considerable interest was aroused some time ago when it was announced that a process for making the material synthetically has been developed in the U.S.A. Considerable quantities of diamond are now being produced within a certain particle size range, and although the price is still appreciably higher than that of equivalent, natural material, there has already been a substantial reduction, and it is hoped that it may be possible in the future further to reduce the gap between natural and synthetic diamond. Cost, however, is not the only consideration, and investigations have recently been carried out by the makers for the purpose of comparing the performances of natural and synthetic particles in typical applications. In this connection it is pointed out that whereas the two types are crystallographically identical and give X-ray patterns that are indistinguishable, there are differences of "crystal habit" which can readily be observed under the microscope.

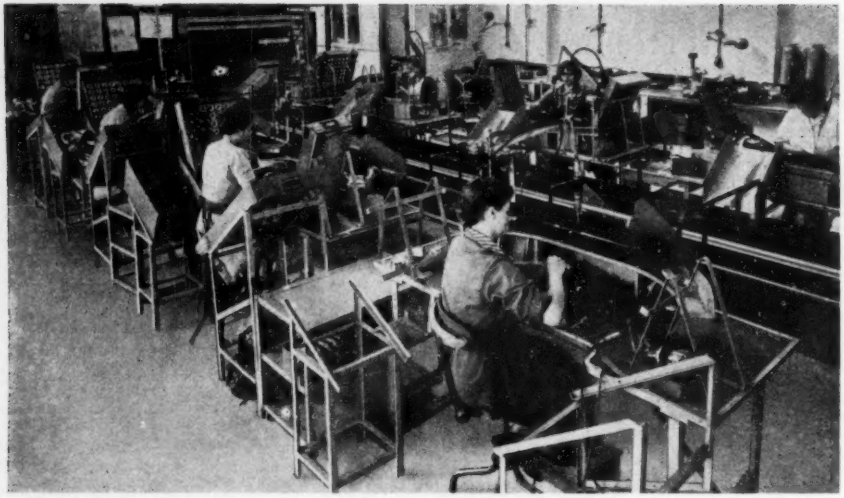
Synthetic particles have rougher and more jagged surfaces and are more friable than those of the natural material, and both these characteristics may be of advantage for certain grinding operations. The jagged form ensures better anchorage in the bond so that there is less tendency for the particles to be pulled out of the wheel before their useful life has been completed. With the greater tendency to fracture, moreover, fresh cutting edges are more frequently presented to the work, so that a freer cutting action is obtained and power requirements are reduced. In practice, despite the fact that individual particles wear more rapidly, more effective utilization ensures greater work material removal for a given reduction in wheel size than is possible with natural diamond.

To enable effective comparative tests to be made, considerable care was taken to ensure that wheels of synthetic and natural diamond were as nearly as possible identical as regards bond, particle size, and curing cycle. Similarly, identical conditions were imposed during practical testing, and the operators were not aware of the compositions of the individual wheels. Preliminary tests in a laboratory showed that power consumption was 20 to 35 per cent less for synthetic than for natural diamond wheels. For one series of practical comparative tests, large numbers of single-point carbide tools were sharpened, and as an example of the results obtained, it is reported that one synthetic wheel ground 19,374 tools as compared with 13,715 for the corresponding natural-diamond wheel. This performance, it may be noted, involved the removal of 45 per cent more carbide.

In general, when employed both for practical tool grinding, and for surface grinding under laboratory conditions, the performance of resinoid- and vitrified-bond synthetic wheels was 35 per cent better than that of natural-diamond wheels from the standpoint of work material removed per unit of wheel wear. It is stated that the surface finish obtained with the synthetic wheels was generally equal, and in some instances superior, to that produced by natural diamond.

The synthetic material has also been employed successfully in metal-bonded wheels for grinding cemented carbide by the electrolytic process, where the unit pressure between the wheel and work is

(*Continued on page* 1311)



The Production of Components for Portable Electric Tools

Examples of Methods Employed by Wolf Electric Tools, Ltd.

At the main premises of Wolf Electric Tools, Ltd., Pioneer Works, Hanger Lane, London, W.5, approximately 350 people are directly engaged in the production of a wide range of electric tools and accessories for the engineering, building, agricultural, and transport industries. The 35 different portable electric tools, which cover industrial and popular "home workshop" types, include drills ranging in capacity from ¼ in. to 1¼ in. Other portable equipment produced includes grinders, sanders, saws, hammers, nut- and screw-runners, and flexible-shaft tools. Special-purpose equipment supplied to the motor trade includes valve re-facing machines, and valve-seat grinding kits.

The Hanger Lane works comprise three factory blocks, two of which are devoted to machining, and the third to armature-winding and associated electrical work. The capacity of the armature-winding shop, it may be noted, is 1,000 armatures per 8½-hour day. Assembly is carried on at Slough, where there are two modern assembly-lines, in separate factories. One assembly factory is concerned with the firm's Wolf Cub and Quarter-master drills, and the other with the range of industrial tools. Approximately 150 operators are employed at Slough, and at both the Slough and Hanger Lane factories, all work is carried out on a batch basis.

GEAR-CUTTING OPERATIONS

Much of the machining work at Hanger Lane is concerned with the wide range of gears for the gearboxes and gear drives of the various power tools produced, and there is an extensive gear-cutting section. A total of 107 different types of gears is required, of diametral pitches from 20 to 48, and including spiral bevel and helical forms. All cluster gears are produced from forgings in En. 24 steel, and for shafts with integrally-machined gears, Kayser Ellison's K.E. 805 bar material is employed. Gear-cutting is carried out to a general tolerance of 0·001 in., and a typical tolerance on splined work is 0·0008 in.

The equipment of the gear-cutting section is modern, and comprises several Pfauter hobbers, and Maxicut and Sykes gear-shapers. Spiral bevel gears are cut on Klingelnberg type FK 40 and FK 41A generators (Sykes Machine Tool Co.,

Ltd.), and are of the Palloid form. These gears have a uniform tooth-depth, and constant width normal to the spiral. The generating principle, and the various machine motions involved, were described in an earlier article in MACHINERY, 90/985—3/5/57.

A typical set-up on one of the FK 40 machines, for producing an 11-tooth pinion with a face angle of 14 deg. 21 min., a pressure-angle of 17 deg. 30 min., and a spiral angle of 44 deg., is shown in Fig. 1. This gear, which has a face-width of 0·433 in., a major diameter of 0·8968/0·8909 in., and a module of 1·59, is machined from K.E.805 material. The corresponding crown-wheel, which is of 3·1465 in. diameter, and has 43 teeth, is of Flather's UBAS case-hardening steel. These gears are used in the firm's 7-in. portable sander, for the right-angle drive, and are produced in batches of 100.

At the set-up seen in Fig. 1, four high-speed steel circular form-cutters are employed, which are run at 300 r.p.m. Cutting is begun with the cutter-head slightly above the work, and the head is fed slowly downwards, through an arcuate path.

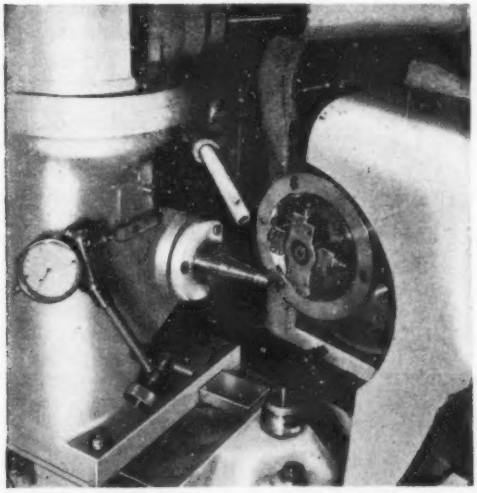


Fig. 1. A Typical Set-up on One of the FK 40 Klingelnberg Machines, for Cutting Spiral Bevel Pinions

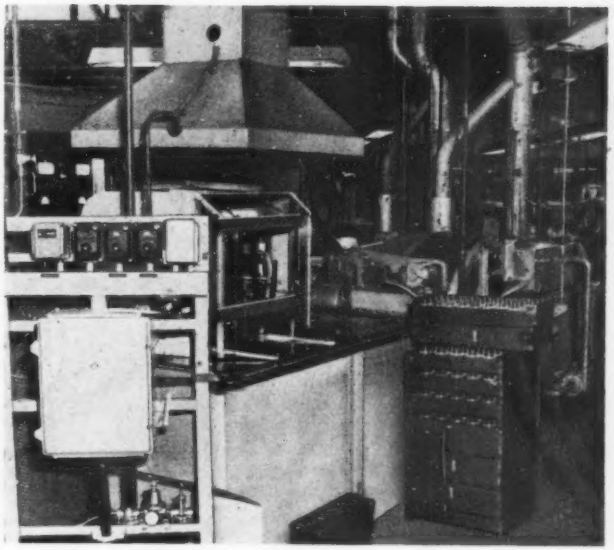


Fig. 2. One of the Three Conveyorized Induction Hardening Lines, Viewed from the Starting End, Showing the 30-kW. Unit

The work is rotated "in mesh" with the cutters, and the machine stops automatically at the end of the cycle, with the cutter-head withdrawn. Each set of cutters is used to machine 25 components, and is then reground. At the corresponding set-up for the crown-wheels, the cutters are reground once for every 18 components machined. The pinions are completed in a floor-to-floor time of 10 min. each, and the crown-wheels in 23 min. each. Subsequently, the pinions are heat-treated to a hardness of 45 to 48 Rockwell C., and the crown-wheels to 58 to 62 Rockwell C.

INDUCTION HARDENING

Adjacent to the gear-cutting section, there is a heat-treatment bay, comprising three mechanized lines, arranged in "broad arrow" formation. This section is devoted entirely to the hardening and tempering of gears, and the arrangement described is employed in order to provide a centralized delivery-point for the treated components.

One of these heat-treatment lines, viewed from the starting end, is shown in Fig. 2, and the other two are generally similar. At the head of each line, there is an induction heating unit, arranged over an oil quench tank, which is equipped with a

three-level conveyor. The induction heating units are fully automatic, and on completion of the heating cycle, the work is released into the quench tank. Here, it is carried to and fro through the oil, at the three levels mentioned, to ensure thorough cooling. From the lowest level, the work is raised by an inclined portion of the conveyor, on which it is allowed to drain, and it is then fed through a Dawson washing machine, to the centralized delivery point.

The induction heating equipment comprises one 30-kW. Wild-Barfield unit, with an induction head designed by Wolf Electric Tools, Ltd.; a 25-kW. Ferranti-Barfield unit; and a 15-kW. Redifon unit. The 30-kW. unit is in the line seen in Fig. 2.

The speed of the conveyors is variable from 5 to 20 ft. per min., and the cooling effect of the three-level arrangement, in conjunction with the accurate temperature control obtainable with induction heating, enables the hardness of the work to be held within two points on the Rockwell C. scale.

A close-up view of the 30-kW. head is given in Fig. 3. It is enclosed in a cabinet with a transparent sliding panel, and is seen set up for a

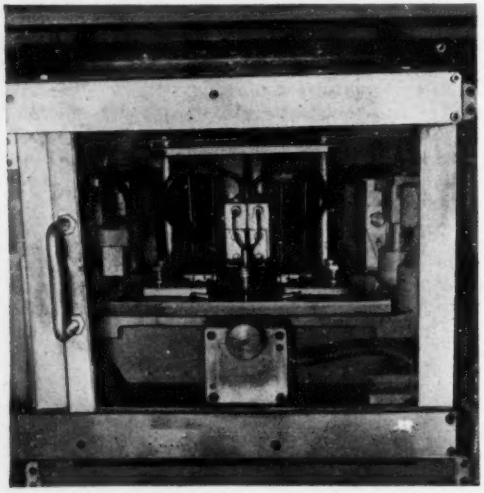


Fig. 3. Close-up View of the Head of the 30-kW. Induction Hardening Unit, Showing the Air-operated Table for Long Components

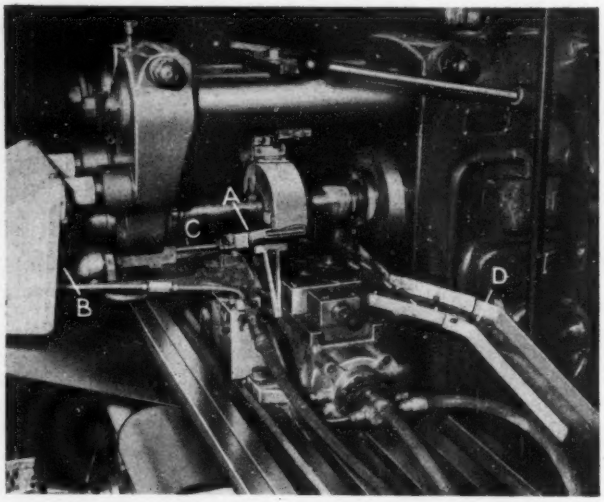


Fig. 4. Archdale No. 1 Horizontal Milling Machine, Equipped for Cutting Flats on Cotter-pins at the Rate of 160 per Hour

2¼-in. diameter gear with a face-width of ⅛ in., which is made from K.E. 805 steel. This gear has a stepped, integral shaft, and is supported in the inductor coil by a pair of trap-doors of asbestos-base insulating material. The shoulder of the shaft rests on the doors, with the reduced diameter portion projecting through locating half-holes in the abutting edges. When the sliding panel is closed, the heating cycle is initiated automatically, and its duration is controlled by an adjustable process timer.

At the end of the heating period, the power is cut off, and the doors open to release the component into the quench tank. When the sliding panel is again opened, for loading the next component, a pneumatic valve is tripped, and the doors are automatically returned to the raised position. The heating period for hardening the component in question is 9¾ sec.

It may be noted that provision is also made for raising and lowering the work-table by means of air cylinders, to enable long components to be treated. When the equipment is arranged to operate in this manner, the action of opening the sliding panel automatically lowers the table. Then, when the panel is closed to initiate the next cycle, the table raises the component into the inductor coil. The set-up can readily be altered to accommodate different types of components, and the inductor coils and trap-doors changed, in about 30 min.

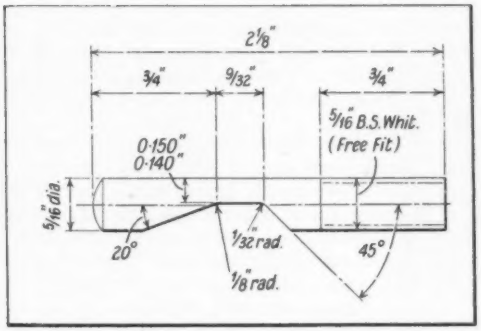


Fig. 5. Principal Dimensions of the Cotter-pins Which are Machined at the Rate of 160 per hour on the Set-up in Fig. 4

AVOIDING HARDENING-DISTORTION

The case-hardening of certain components for the firm's power tools is carried out in a cyanide heat-treatment department associated with the main machine-shop. Here, a simple procedure is followed in order to minimize the distortion of components of En. 24 steel, when they are subjected to quenching after removal from the cyanide bath.

The components are gears with integrally-machined dogs, and it is important that even slight distortion should be avoided. After the work has been heated for 45 min. in a cyanide bath at 850 deg. C., it is hung over an oil quench-tank, near a permanent magnet. As soon as the work cools to a temperature at which its magnetic properties return, as indicated by the fact that it is attracted towards the magnet it is lowered into the quenching oil. Subsequently, the components are tempered for 60 min. at 630 deg. C., in a salt-bath of I.C.I. Carboquench, to a hardness of 35 to 40 Rockwell C. With this treatment, distortion is consistently avoided.

AIR-OPERATED EQUIPMENT

Throughout the firm's machine lines, extensive use is made of air-operated equipment of their own design. Such equipment is provided, for example, on the Archdale No. 1 horizontal milling machine shown in Fig. 4, which has been arranged for milling flats on cotter-pins, to the dimensions shown in Fig. 5, on a fully-automatic basis. Reference has previously been made to this set-up in MACHINERY, 89/49—6/7/56, but as it presents features of unusual interest it is described here in greater detail. Referring to Fig. 4, the components are placed, all the same way round, in an inclined magazine *A*, which is mounted on the side of an Enots air-operated vice, with the lower end in line with the recessed jaws. Also mounted on the side of the vice is an air-cylinder *B*, which is connected to the rod *C*.

The machine table is arranged to reverse automatically at both ends of its travel, and each time the vice-jaws move clear of the cutter, in either direction, they are opened just sufficiently to release the work. At the same time, the air-cylinder *B* is actuated, and the rod *C* pushes a fresh component out of the magazine into the jaws, so that the machined component ahead of it is ejected into the chute *D*. The jaws then close, the table is reversed, and the work is carried beneath the cutter, with a feed of 6½ in. per min. The 4-in. diameter 21-tooth cutter is run at 205 r.p.m., and

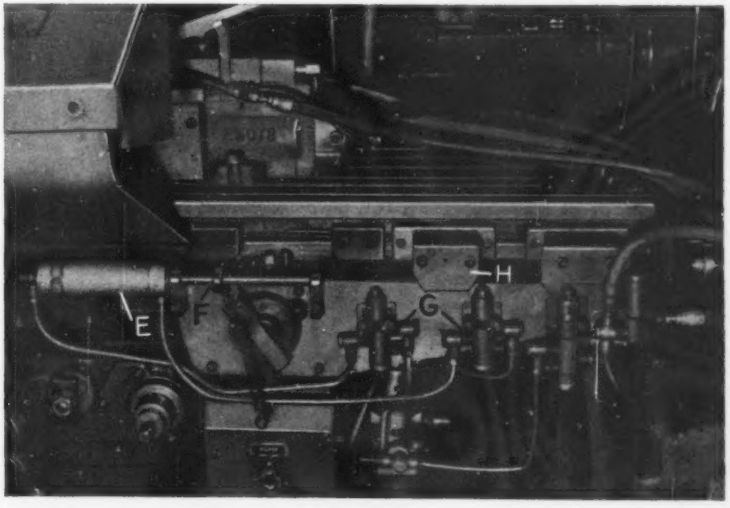


Fig. 6. Side View of the Archdale Machine, with Guards Removed, Showing the Air-valves, Cam-plates, and Reversing Cylinder

160 machined components are delivered per hour. Since the magazine *A* is of comparatively small capacity, it must be replenished manually at fairly frequent intervals. It will be evident, however, that the same equipment could be employed, if required, in conjunction with a hopper-feed unit.

The various automatic functions are controlled by a series of Maxam air-valves, attached to the bed of the machine, and actuated by cam-plates mounted on the edge of the table, as shown in Fig. 6. This equipment, it may be noted, is normally enclosed in a guard, which has been removed to enable details to be observed. On the standard Archdale No. 1 horizontal milling machine the table is reversed by means of a hand lever. For the set-up described, however, reversal is effected by the air-cylinder *E*, which is arranged to actuate the lever by means of the collar *F*. This cylinder is controlled by the two valves *G*, and the associated cam-plate *H*. The other valves provide for the supply of air to the loading cylinder *B*, Fig. 4, and the cylinder for operating the Enots work-holding vice.

FINE-BORING

In Fig. 7 is shown one of several Drebomat 2-spindle fine-boring machines (Sykes Machine Tool Co., Ltd.) which are employed for various operations on the die cast bodies for portable drills. At the set-up illustrated, the rear bearing bosses of bodies for OK, HQ, and KG drills are bored to 0·5000/0·5005 in. diameter,, and machined to 0·623/0·625 in. outside diameter. In addition, a flat area at the root of each boss is faced to give an overall length of 3·937 in., and a small hole for an oil wick is drilled through the boss wall by means of a portable pneumatic drill, seen at *A*. This drill, and pneumatic equipment whereby it is operated automatically, were fitted by the company.

Two identical fixtures are employed, and the work is machined in two stages, for the first of which it is set-up on the fixture at the rear. Each fixture comprises a mandrel of special section, which locates the work by the main bore, and is provided with a pair of hydraulically-operated claws. The mandrel and claws of the second-stage fixture, at the front, may be seen at *B* in Fig. 7, and the hydraulic cylinders at *C* actuate the claws, through drawbars.

When the ball-ended control lever is moved to the "clamps on" position, the claws first move outwards to engage the work internally, and then to the right, to hold the rear end against three flat pads at the base of the mandrel. During the automatic cycle, the work-table is first rapidly advanced, and then slows to the cutting feed of 4 in. per min. The spindles are run at 1,150 r.p.m.

On the rear spindle, there are three carbide-tipped tools, one of which machines the bore to within 0·015 in. of finished size. A second tool machines the external diameter oversize by a similar amount, and the third faces the area at the root of the boss. This third tool is carried on a small cross-slide, which is fed radially outwards by a diagonal-tooth rack arrangement. The driving rack member is actuated by a hydraulic cylinder, through a rod housed within the spindle. Meanwhile, a component previously machined at the first station is finished at the second by two tools which turn and bore the boss to the dimensions already indicated.

At the end of the

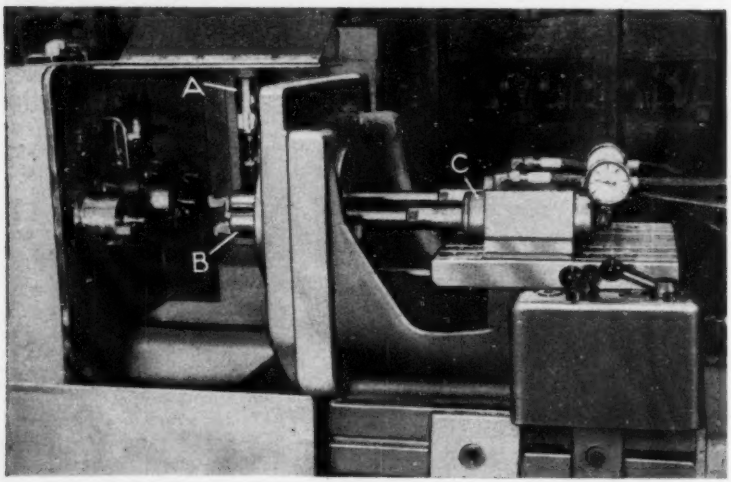


Fig. 7. This Drebomat 2-spindle Fine-borer, Employed for Machining Drill Gun Bodies, is Equipped with a Pneumatic Drill at *A*

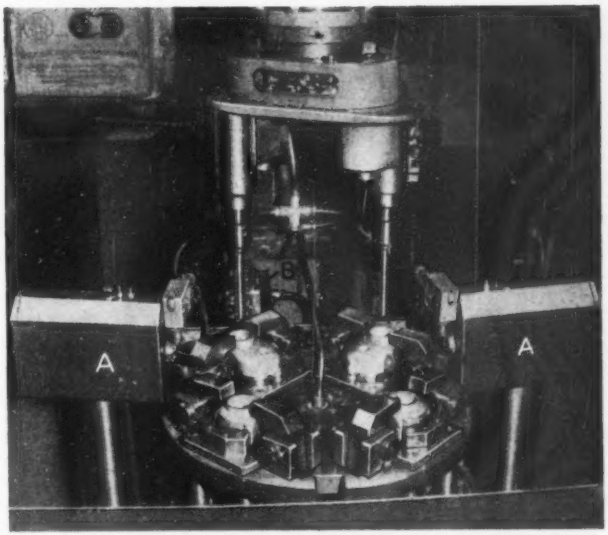


Fig. 8. This Wolf Air-operated Indexing Fixture, Set Up on a Pollard Drilling Machine, is Employed for Boring Three Types of Gearboxes

stroke, the work-table is rapidly withdrawn, the machine stops, and the automatic cycle of the pneumatic drill is started. This drill, it may be noted, is mounted vertically above the work at the first station. The Drebomat machine is hydraulically operated throughout, and the impulse for initiating the cycle of the drill is derived from a tapping taken from the main hydraulic circuit.

The drill is on a vertical slide, and feed is applied by an air-cylinder, against hydraulic damping. When the hole has been drilled, the slide is rapidly raised, and the drill stops. Finally, the component is transferred to the second station, and the first station is reloaded. The two stages are completed on 40 components per hour.

AUTOMATIC INDEXING FIXTURE

In Fig. 8 is shown a set-up on a Pollard column-type drilling machine fitted with an air-operated automatic indexing fixture, which was also designed and built by the company. Employed for boring operations on gearboxes for the firm's Wolf Cub, type HQ, and OK drills, the fixture has four stations, and is used in conjunction with a Hey 2-spindle head. At each station, the work is located by an internal register, and is secured by two claw-type clamps. These clamps are pivoted to lugs on the top-plate of the fixture, and each pair is actuated by an air-cylinder mounted on the lower portion. Also mounted on the lower portion of the fixture, there are switches which control the air-supply to the cylinders by means of solenoid valves.

Surrounding the lower portion of the fixture, at the rear, is a stationary, 180-deg. cam-ring. As the table indexes, the switches are engaged and operated by the cam-ring, so that the clamps for the stations on the rear half of the fixture are closed, whereas those for the front stations are open. Loading and unloading are carried out at the front, during the working cycle. At the end of the cycle, the spindle-head is automatically raised, the table indexes, and the machine stops. The next cycle is initiated by feeding the head down manually, to engage the power feed.

Each spindle carries a piloted boring-bar with two cutters, which is driven at 600 r.p.m. At the first station, the main bore is machined to 1·245 in. diameter, the bottom of the bore is faced, and a shallow counterbore of 1·290 in. diameter is formed. At the second station, these diameters are opened out to 1·2592/1·2598 in. and 1·304/1·305 in., and the bottom of the main bore is finish faced. A machined component is unloaded every 30 sec. Referring again to Fig. 8, it will be seen that a horizontal drilling head, *A*, is provided at either side of the fixture. These heads are only used when the set-up is employed for machining Wolf Cub components, and each houses a pneumatic drill.

On the Wolf Cub component, there is a projection that is not present on the gearboxes for the other drills mentioned, and this feature is utilized to control the automatic cycle of the horizontal drills. Mounted on the machine column, there is an additional switch *B*, which is actuated, by the projection, when the work is indexed beneath the main first-stage spindle. This switch operates solenoid valves which control the supply of air to the pneumatic drills, and this supply serves both to drive the spindles, and to provide the feed motion. The latter is hydraulically controlled, and when the holes have been machined, the drills are rapidly withdrawn. Additional switches are mounted on the heads in such a manner that each is opened when the

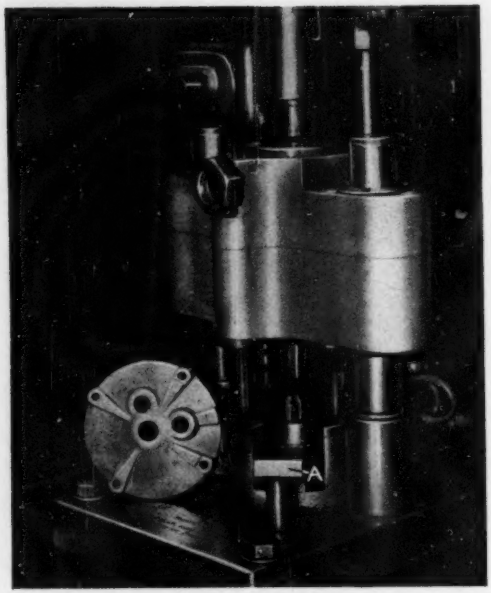


Fig. 9. The 2-spindle Head, Here Shown, is Set Up on a Pollard Drilling Machine, and is Used for Boring Inner Gear Plates to a Diameter Tolerance of 0.0008 in.

spindle is advanced, and closed when it is fully withdrawn. These switches ensure that the indexing motion of the fixture can only take place when both drills have been withdrawn. No. 55-size drills are employed, and with this arrangement, two holes are drilled in each component during the normal machine cycle.

MACHINING INNER GEAR-PLATES

Another set-up on a Pollard column-type drilling machine, for boring two holes in an inner gear-plate for the firm's type WD3c portable drill, is shown in Fig. 9. As received, the component has one bore, in the centre, already machined, and at this set-up, the two additional holes are bored to 0·6246/0·6254 in. diameter. Subsequently, all three holes are bushed for the armature and gear shafts, and at the boring operation, the centre-distances between them must be maintained within ±0·001 in. A 2-spindle boring head, designed and constructed by the company, is arranged to slide on two vertical pillars on the base of the fixture, and has a 1:2 ratio, so that the boring spindles are driven at twice the speed of the drill spindle. The gears and spindles of this head, it may be noted, run in needle roller bearings.

The work is located from the centre hole by a split spring mandrel, and is supported horizontally on hardened steel pads. Projecting from one of these pads, there is a pin that serves to locate the work angularly, by one of the four stud-holes near the periphery. An air-line is coupled to the head, to apply pressure to four plungers. When the automatic cycle is initiated, and the head is fed downwards, these plungers seat the work firmly on the horizontal pads. The spindles are run at 1,200 r.p.m., and a feed of 0·005 in. per rev. is employed.

Each spindle carries three carbide-tipped tools, the first of which machines the bore to within 0·015 in. of finished size. The second tool finishes the bore, and the third chamfers it at 15 deg., to provide a lead for pressing in the bushes. A coolant supply-line is also coupled to the head, which incorporates pipes whereby it is conveyed to two nozzles, directed at the tools. Air-jets are provided, on the base of the fixture, to clear away swarf. At the end of the cycle, the spindle-head is automatically raised, the machine stops, and the work is stripped from the mandrel by depressing the lever A. This lever actuates a sliding collar which surrounds the mandrel. The operation is completed on each component in a floor-to-floor time of 0·9 min.

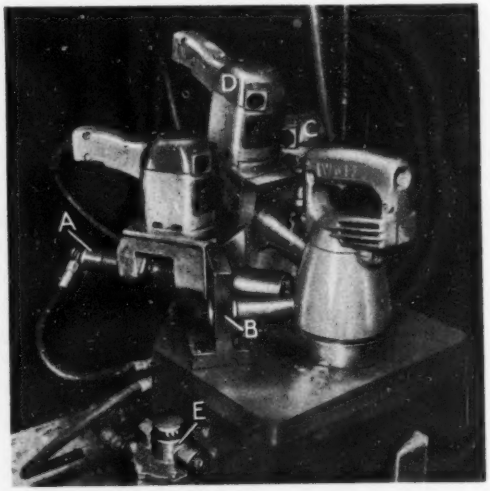


Fig. 10. This Special-purpose Machine, Designed by the Company, Incorporates Three Wolf Electric Drills. The Spindles are Hydraulically Operated

SPECIAL-PURPOSE DRILLING MACHINES

The company has designed and built a number of special-purpose machines, in which Wolf portable electric drills are employed. An example, shown in Fig. 10, incorporates three EG2c light production drills, provided with special right-angle drive gearboxes and hydraulically-operated spindles. This machine is employed for drilling three No. 47-size holes in type WD2c drill-gun bodies, one of which is seen in position, and two No. 55-size holes in gearbox housings for the same gun. These holes provide for attaching name plates, by means of rivets. The tooling for the two components is so designed that it is readily interchangeable. A register spigot locates the body by the internal diameter at the open end, and the latter rests on three flat pads. Angular positioning is obtained by means of a spring-loaded pad, which fits the internal form of the shell.

Mounted centrally on the top of the register spigot, there are two claws, which are operated by a pedal. When the pedal is depressed, these claws move outwards, into engagement with the brush-holder holes, and then downwards, so that the work is clamped against the flat pads. Continued steady depression of the pedal then causes the spindles to advance, to drill the work. During this phase of the cycle, the pedal operates a hydraulic master cylinder, which supplies a small feed-cylinder *A* at the rear end of each spindle. When the pedal is released, the spindles are withdrawn by return-springs. The spindles are driven at 2,800 r.p.m., through bevel gears.

As may be observed in Fig. 10, an alternative drill head mounting is provided at *B*, for use when drilling the gearboxes. One drill-head, indicated at *C*, is transferred to this position, and another, seen at *D*, is disconnected. The fixture for the gearboxes comprises a register-spigot with three flat pads, and has no provision for clamping. Both fixtures have air-jets, to keep the pads free from swarf. Each jet takes the form of a narrow horizontal slit, level with the top of the pad, to which air is fed intermittently by an Enots diaphragm-type puffer valve *E*. This valve, which is adjustable for frequency of pulsation, permits economy in air consumption, and the cleaning effect of the intermittent delivery is greater than that of a continuous air-stream. The machine described, it may be noted, is built on a pedestal of the type employed for the firm's 6-in. and 8-in. grinding and polishing spindles. On each type of component, the operation is completed in a floor-to-floor time of 12 sec.

Another special-purpose machine, for performing similar operations on three types of drill-gun bodies, is shown in Fig. 11. This machine, which operates on a fully-automatic cycle, initiated by means of a push-button *A*, also incorporates two Wolf electric drills. These drills are fitted with special 2-spindle geared heads, and are mounted on air-hydraulic, horizontal slides. The four No. 44-size drills are steadied by bush plates. Th arrangement for locating the work is generally similar to that employed on the machine already described, and clamping is effected by means of the vertical air-cylinder. Interchangeable fixtures are provided, to accommodate the different types of components, and these fixtures, again, incorporate pulsating air-jets.

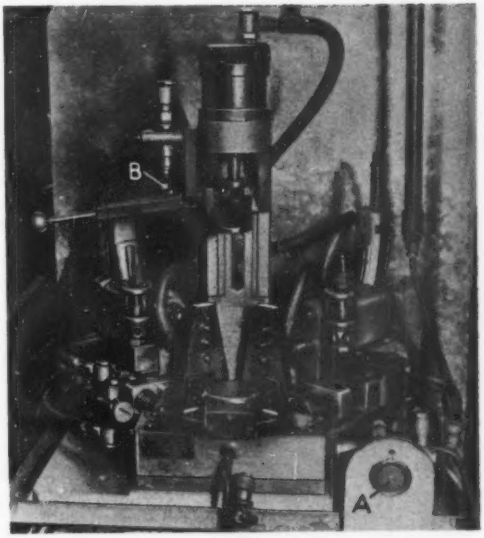


Fig. 11. The Pneumatically-operated Machine Here Shown is Fully Automatic, and Incorporates Two Wolf Electric Drills

The ram of the clamping cylinder is spring-loaded downwards, and is raised, by means of the hand-lever, for inserting the work in the fixture. When the button *A* is pressed, this cylinder is energized, before the drilling-heads advance. Pivoted to the clamping-cylinder support, the lever is provided with a mushroom-head screw *B*, which engages the stem of a plunger-type air valve. Unless the stem of this valve is deflected upwards sufficiently, the feed cylinders remain isolated. The screw is set so that when the work is seated correctly on the horizontal pads of the fixture, the valve is just opened.

Should the work be slightly displaced upwards,

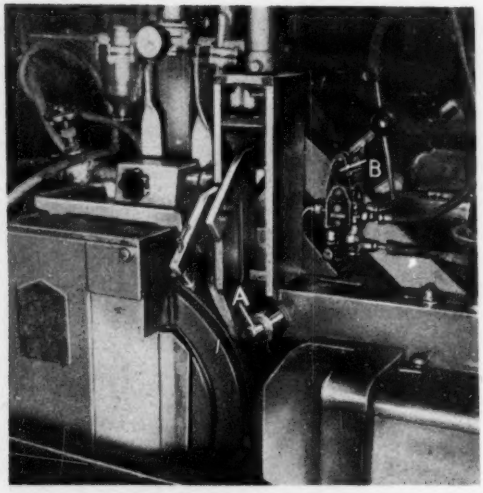


Fig. 12. This Air-operated Loading Device is Employed on a Scrivener No. 2 Centreless Grinder

however, due to swarf on the pads or careless loading, the valve-deflection is insufficient to admit air to the feed cylinders. Another safety device is incorporated, which ensures that drillheads cannot advance unless the spindles are running. Provision is also made for automatically turning on and off the supply of soluble-oil coolant, which is delivered through a nozzle mounted between each pair of steady bushes. These nozzles are of a double-orifice type, and each delivers separate jets to the two drills. With the equipment described, the four holes are drilled in each component in a floor-to-floor time of 18 sec.

LOADING ARRANGEMENT FOR A CENTRELESS GRINDER

In the grinding section, a Scrivener No. 2 centreless machine is employed for roughing and finishing operations on the chuck spindles for the firm's type HQ drills. These spindles have two diameters, of ⅜ in. and 12 mm. (0·4724 in.), on either side of a narrow collar, which are held to limits of ±0·0002 in. As received, the components are approximately 0·010 in. oversize on both diameters, and they are ground in two roughing stages and a finishing stage. Paired wheels are employed, which are spaced by the width of the collar, and the work is lowered between them, on to the rest, by the air-operated loading-device shown in Fig. 12.

The 20-in. diameter, 1-in. wide, grade A60 N5V, Norton main wheels are run at 1,200 r.p.m., and the 10-in. diameter by 1-in., grade A 100 NR VE, Universal control wheels, at 39 r.p.m. The loading-device comprises an arm mounted on a rectangular plate, which has a spigot projecting from either side. These spigots slide in vertical guide grooves in the side-members of a frame that supports a vertical air cylinder, to the rod of which the plate is coupled by a pivot.

At right-angles to the arm, near the lower end, there is a pin approximately 0·02 in. smaller in diameter than the bore of the work, which is placed over it. The component is retained so that it can revolve freely, without end-play, by a spring-loaded pawl. When the arm is in the working position, it is held vertical by a stop-pin *A*, which engages the rear face. It is also located at such a height that the component is supported on the work-rest with the pin just clear of the bore. When the work has been ground, the air-cylinder is actuated by means of the hand-operated valve *B*, and the plate and arm are raised.

Initially, the arm remains vertical, but once the work is clear of the wheels, the rear edge of the plate is engaged by a pair of pegs on the inner faces of the air-cylinder supports. Thus, during the last portion of the travel, the plate is tilted about its spigots, so that the arm is swung forward to the loading position. It may be noted that, in order to accommodate the offset between the centres of the spigots and the pivot connection for the air-cylinder rod, the upper ends of the guide grooves are curved. When the arm is lowered, to load the next component, the movements are reversed. At this set-up, the floor-to-floor time per component is 10 sec., and during the automatic cycle, the operator checks the work on a dial comparator. At the finish grinding stage, approximately 0·0015 in. is removed from the diameter.

ASSEMBLY ARRANGEMENTS

The arrangements at the firm's assembly factories at Slough are based on efficient motion-study and flow-line methods. These methods were introduced in 1954, when the acquisition of the second factory afforded an opportunity for complete reorganization. As a result of this reorganization, the overall output was doubled within 18 months, and the output per operator increased by 30 per cent. Among the various sub-assembly operations performed in the factory devoted to industrial tools, is that of pressing the porous-bronze self-lubricating bushes into the gearboxes and inner gear plates for the firm's recently-introduced type WD2c heavy-duty portable drills. The assembled gear-

box, and the inner gear plate, are shown in Fig. 13.

The tolerance on the external diameter of the porous-bronze bushes is 0·001 in., whereas that on the bore, after they have been pressed-in, is 0·0004 in. Because they are an interference fit in the housings, the bushes are compressed, so that the bore diameter is reduced. In order to maintain the 0·0004-in. bore tolerance, therefore, hard chromium-plated sizing pins are employed. The bush-housing in the gearbox, for the shaft *A*, Fig. 13, is blind, and the equipment for inserting and sizing the bush is shown in Fig. 14.

The fixture is set-up on a 1-ton Hi-Ton hydraulic press, and the bush to be inserted is placed on the sizing pin at *B*. The gearbox is then placed over it, and is located by registers on a spring-loaded stripper sleeve *C*. When the press is operated, a steel pad on the ram engages the end of the chuck-spindle boss, and a nylon pad *D* engages the body of the component. This 2-point arrangement is employed, because there is no convenient area, vertically above the bush, to which pressure could be applied by a single pad. The component is pushed down over the bush, and the stripper sleeve *C* is meanwhile depressed. In this way, it is ensured that the bush is inserted squarely. If, when the ram is raised, the strength of the stripper sleeve springs is insufficient to strip the bushed component from the sizing pin, the hand-lever *E* is pushed towards the rear, and the press is again operated. The sizing pin is then pressed downwards by the side-rods *F*, so that it is withdrawn from the bush. By this method, the bushes are inserted in 250 gearboxes an hour, and the bore tolerance indicated is maintained.

For pressing-in and sizing the three bushes of the inner gear plate, a set-up on an arbor press is employed, and the operation is somewhat simplified by the fact that none of the holes is blind. The fixture, shown in Fig. 15, comprises a recessed plate on which the component is located by a machined register, and by one of the four stud holes. Loose sizing pins are employed, each of which has a reduced diameter portion with a groove. The bush is placed over the sizing portion, and a collar, with a spring-loaded ball, over the reduced portion, where it is retained by engagement of the ball with the groove. The pin is then inserted through one of the bores in the work, and the lower end is located in a hole in the base of the fixture. When the press is operated, the collar engages the end of the bush, and the latter is pressed squarely into the bore, guided by the pin. The collar is then removed, and the pin

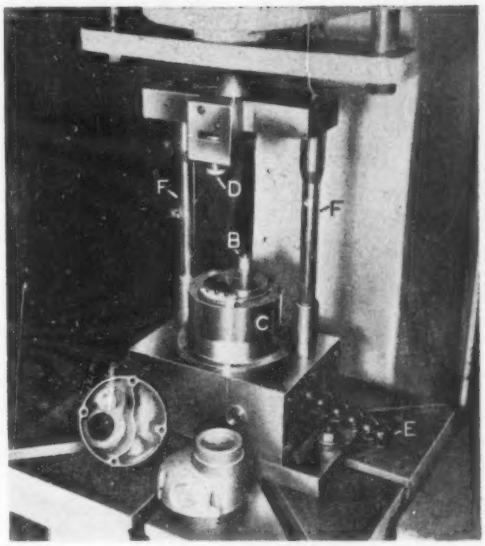


Fig. 14. At this Set-up, on a Hi-Ton Hydraulic Press, a Porous Bronze Bush is Inserted, and Sized with a Hard Chromium-plated Pin

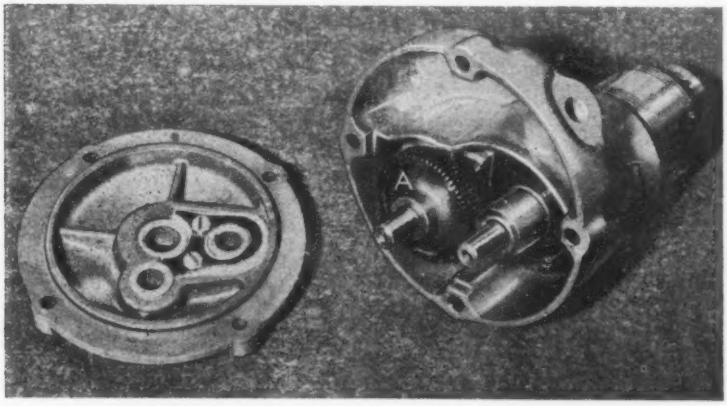


Fig. 13. Type WD2c Gearbox and Inner Gear Plate in which Self-lubricating Bushes are Inserted

Fig. 15. Set-up on an Arbor Press for Inserting and Sizing Inner Gear Plate Bushes

ejected through the hole in the fixture, by again operating the press. With this equipment, the three bushes are inserted in 60 to 70 gear-plates per hour.

In Fig. 16 is shown a fixture which is employed for assembling the main spindle bearing and the chuck. As may be observed, a cluster-gear is incorporated, which facilitates the assembly of the chuck. The main spindle is inserted in the bush adjacent to the built-in gear, and the gearbox is placed over it, and located by a register-step on the base of the fixture. Next, a ball bearing is pressed simultaneously into the housing, and over the spindle, on an arbor press, and a screwed retaining ring *A* is assembled with the aid of the tool *B*. A spacer is then slid over the spindle, and, finally, the chuck is screwed on to the spindle with the aid of a C-spanner, the built-in gear meanwhile serving to prevent the spindle from rotating. Flats on the larger gear and the adjacent bush housing serve to hold the cluster stationary. With this equipment, 45 gearboxes are assembled per hour.

FINAL ASSEMBLY LINE

In the factory devoted to Wolf Cub drill production, assembly is carried out on the conveyorized line seen in the heading illustration. The conveyor has three channels, and the outer channels serve the assembly stations, at each of which a girl operator is responsible for building complete assemblies. This work includes four sub-assembly operations, as follows: assembly of contact arms to switch-blocks; assembly of the ball, spring, and the plunger for the trigger; insertion of the brushes and oil pads in the brush holders; and stripping the Gloscote protective covering from the armature spindle pinions, and assembling washers.

Bi-manual arrangements are provided at the assembly stations, and mechanical aids, such as power runners, are employed where possible. A typical assembly station is shown in Fig. 17, with one of the cradle fixtures used to facilitate final assembly. Constructed from wood laminate, the fixture provides for two alternative positions of the work.

Assembly is begun by inserting the studs for securing the switch-gear, and, for this purpose, a roller-type, self-releasing stud box, mounted in a power runner, is employed. Next, the field-core assembly is inserted in the body, and secured by two screws, tightened with a Desoutter pneumatic runner. A fibre collar is placed over the arma-

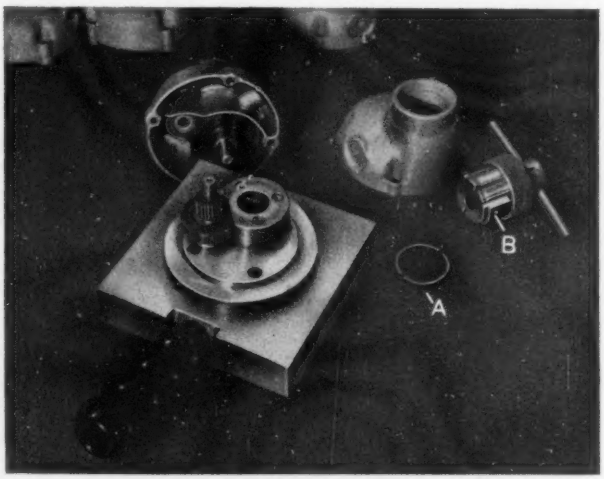


Fig. 16. This Fixture, Incorporating a Gear Cluster, is Employed for Assembling the Main Spindle, Ball Bearing, and Chuck

ture spindle, and the latter is inserted through the rotor space into the bearing. The gearbox is then assembled and secured by three screws, after which the cable is inserted through the bottom of the handle and connected to the earthing screw.

Subsequently, the switch and trigger are installed, and the brushes are fitted to the motor-frame. The various connections are completed, and, finally, the switch-cover is assembled, by means of a screw and nut. As mentioned earlier, all work is carried out on a batch basis, and between the main assembly batches the same operators assemble gearboxes, in addition to performing the sub-assembly operations indicated above. In the course of a normal working day, each operator assembles up to 75 complete drills, apart from these additional duties.

As each drill is completed, it is placed in a chute that delivers it to one of the outer-channels of the conveyor. The latter carries the tool to one of a number of test stations on either side of the line. At these stations, the drills are subjected to a 20-min. running test, and a check for vibration, temperature rise, mechanical faults and current consumption. After this test, the tools are placed on the central channel of the conveyor, which carries them to a sound-proof booth. Here, they are flash-tested, and checked for noise, also for electrical continuity. Subsequently, the drills are placed on a monorail conveyor, which carries them to paint-spraying booths and a drying chamber, whence they are transferred to the packaging lines.

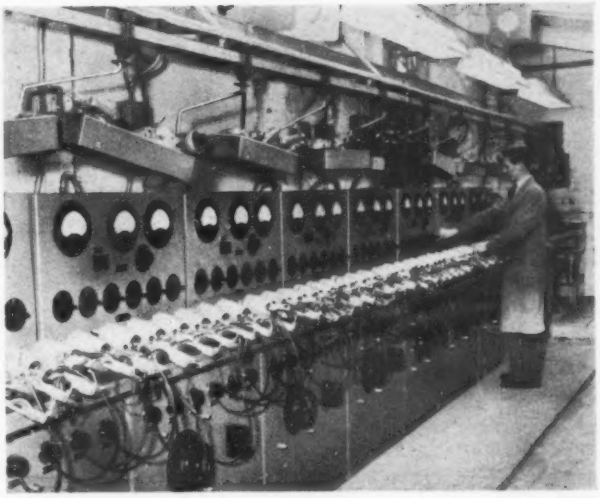


Fig. 18. Part of the 12-panel Testing Bench in the Factory for Assembling Industrial Tools. A Wide Range of Current Supplies is Available

Fig. 17. Typical Assembly Station in the Wolf Cub Line, Showing Cradle-type Fixture and Bi-manual Layout

In the factory devoted to industrial tools, assembly is carried out at a series of bench stations, served by monorail conveyors. Testing is performed in a separate shop, and the equipment installed for this purpose is shown in Fig. 18.

The bench comprises 12 panels, each capable of accommodating six tools, and the following current ranges are provided: 32- to 250-volt single-phase A.C.; 50- to 250-volt D.C.; and 415-volt, 3-phase A.C. The machines are run for 30 to 60 min., according to type, and are meanwhile checked for current consumption, temperature-rise, and r.p.m. Flash-testing is performed at a bench-station which is located at the extreme right-hand end of the line.

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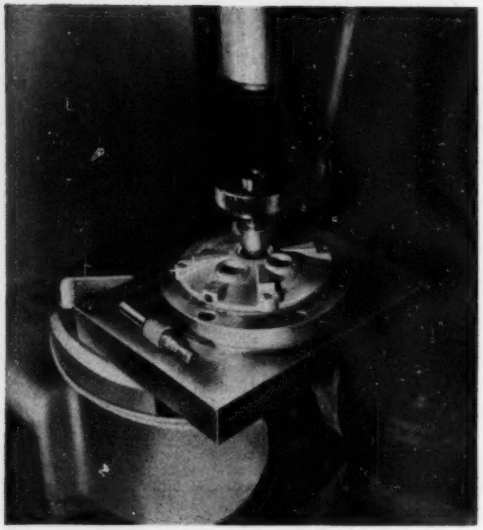

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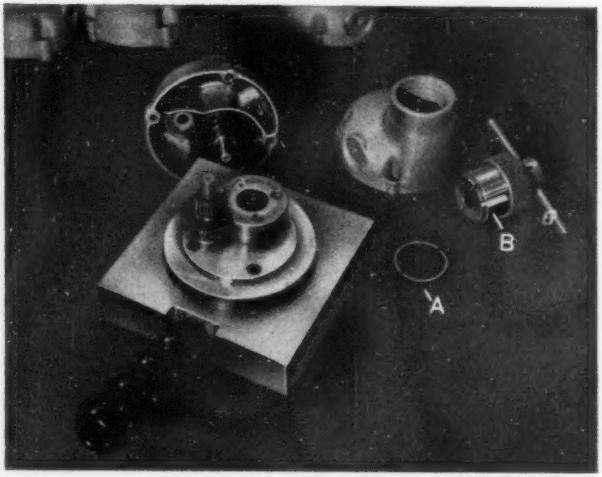

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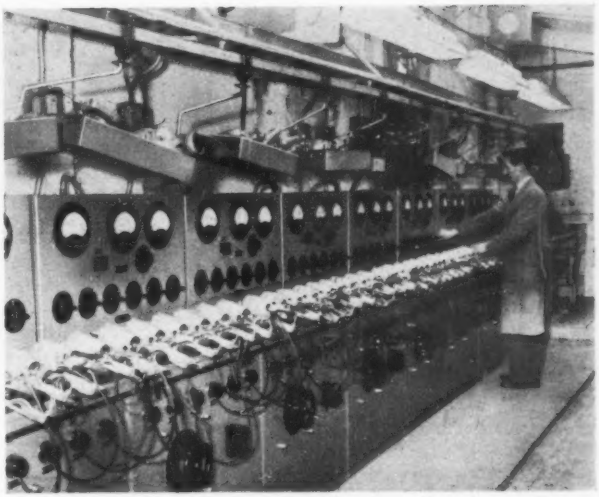

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East German Machine Tools at the Leipzig Fair

From the variety of machine tools of advanced types exhibited by the German Democratic Republic at the recent Leipzig Fair, which were representative of the products of some 45 factories, it is evident that design development and expansion of output in this field are being given high priority. The building of machine tools, indeed, now constitutes one of the most important factors in the country's economy both as regards the equipment of East German metal-working plants, and for export to foreign markets. Under the planned economy, East German machine tool factories have been progressively extended and modernized, and the stage now appears to have been reached at which both light and heavy machine tools, of nearly all the types required, are being produced. During the two years 1955 to 1957, it is stated, machine tool output increased by some 62 per cent, and special emphasis is being placed, by the Central Office for Standardization, of the Institute for Machine Tools, on the rationalization of machine tool types, unit construction, and the development of transfer machines and other types of high-production equipment embodying the most up-to-date features.

As an indication of the progress that has been made, may be mentioned the demonstration, at Leipzig, of an 11-station, platen-fixture, in-line transfer machine, attended by only one operator, for machining seven sizes of cast-iron valve bodies, also a completely automatic line, comprising a multi-spindle bar automatic and three Madgeburg second-operation lathes, for producing rings for ball bearings. A rotary transfer machine, unusual in that it was designed to carry out internal grinding operations, was equipped with feed-back size control between the roughing and finishing stages. It may also be noted that size control, with automatic infeed compensation, was provided on a hopper-fed centreless grinder. An internal and face grinding machine, designed for a high-production application, incorporated a horizontal, 4-spindle indexing work drum, and was fully-automatic in operation, apart from work loading and unloading. In addition, reference may be made to a vertical, 2-spindle honing machine, with automatic size control by means of air gauging jets built into the honing heads.

Thread grinding machines of new design, also a double-column jig borer incorporating precision lead screws, were shown, together with a turret lathe with automatic cycle control by means of punched cards. Among the larger machine tools, may be mentioned a newly-developed vertical turning and boring mill with automatic cycle control and electrically-operated copying equipment. The well-known Union horizontal borers, which are being exported in appreciable numbers, were represented by an improved design of 5-in. spindle machine. Of particular interest, although exhibited only in model form, was a large broaching machine for cutting teeth in spur gears up to 23 ft. diameter.

Considerable development work is being carried out in connection with transfer presses and very large mechanical presses—the latter by Pels—also cold forging machines and thread-rolling machines. A flat-die thread-rolling machine, which has been introduced, is fitted with two hoppers and feed channels, and is arranged to thread-roll a component at each stroke of the die slide. Two workpieces at a time were being thread-rolled on a circular die machine, also arranged with double feed channels. In a more specialized field, two presses for the production of expanded metal were demonstrated, which incorporated patented features. Spark erosion and ultrasonic machining units were also noted, together with a range of induction heating equipment, including an automatic machine for hardening gear teeth. Further details of some of these East German machine tool developments are given here, and others will be considered in subsequent issues of MACHINERY.

TRANSFER MACHINE FOR VALVE BODIES

An indication of the advanced stage that has been reached in the construction of in-line transfer machines in East Germany is afforded by the 11-station installation shown in Fig. 1, which has been designed to carry out facing, boring, drilling and lapping operations on seven sizes of cast-iron valve bodies. In addition, the sequence provides for the assembly and machining of a brass seating ring.

The workpieces are carried on roller-mounted platen fixtures which are indexed hydraulically through the machine and are returned along an

overhead chain conveyor, as seen at A in Fig. 2, which is a view of the starting end of the machine. From the chain conveyor, the platen is indexed on to a wheeled trolley, which is lowered by chain down inclined runways to the unloading and loading station. A similar inclined runway is provided at the delivery end, for lifting the platen and workpiece to the level of the overhead conveyor, after the fixture clamps have been automatically released at the last working station. With this inclined arrangement, the amount of floor space required for the machine is reduced to a minimum. At the same time, no limitation is imposed on the use of vertical spindle heads. Only one operator is required to tend the machine, and the cycle time ranges from 47 to 60 sec., according to the size of valve body being handled. The valve bodies seen in the illustrations measure 9 in. long over the flanges.

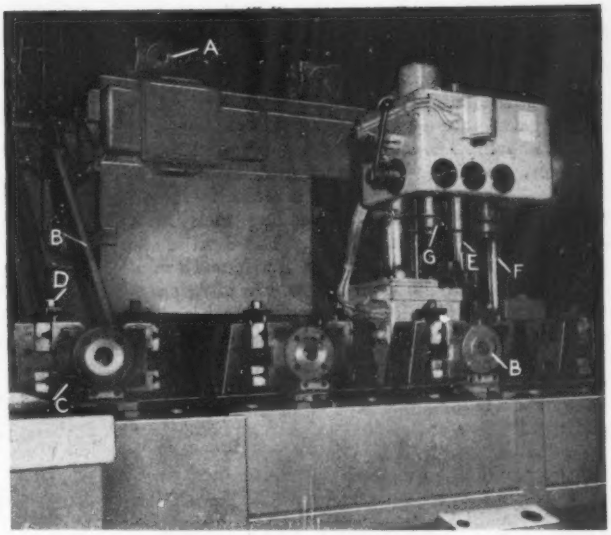

Fig. 2. View from the Starting End of the Transfer Machine for Valve Bodies

Referring to Fig. 2, the casting is loaded between end locations in the fixture, and is initially supported by the flange peripheries on rollers in preparation for clamping at station *B*. Clamping on each flange is effected by right- and left-hand jaws *C*, which are locked by means of wedges as the nuts *D* are tightened. The clamping head at station *B* is moved down hydraulically, under hand lever control, so that the casting is held in the fixture by four prongs on a vertical bar *E*. Clutch teeth on the end of a vertical shaft *F* engage a mating member on the platen, and when a second control lever is moved, the clutch shaft is rotated by means of a hydraulic motor to move the left- and right-hand jaws into contact with the casting. Locking of the wedges is then effected by mechanically-driven nut runners *G*, controlled by a third lever. A head of similar design, but without the hold-down member, is provided for releasing the casting at the de-

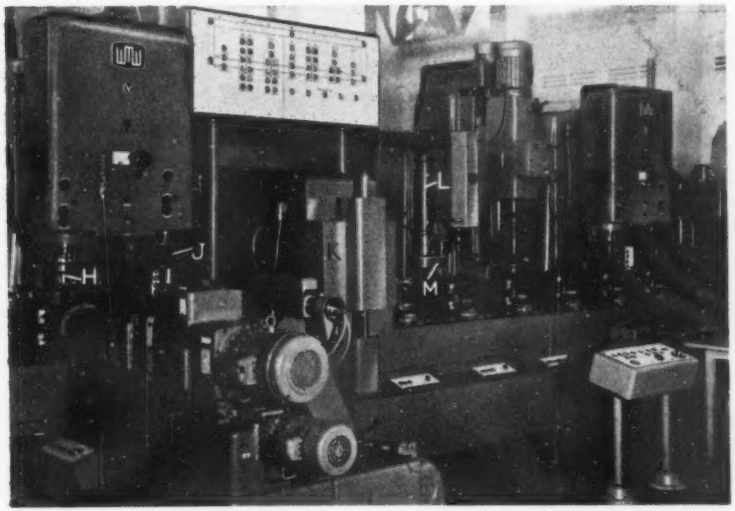

Fig. 1. General View of the 11-station Transfer Machine, Built in East Germany, for Handling Seven Different Sizes of Cast Iron Valve Bodies

livery end of the machine, as shown in Fig. 3. The clutch shaft *F* is here seen more clearly.

At the first working station, four holes of 18 mm. (0·709 in.) diameter are drilled in one flange, by a rear horizontal spindle head, while four holes in the gland face of the casting are drilled with a vertical head. The latter holes are tapped 12-mm. diameter, under lead screw control, at the next station, at which the rear flange is faced, by means of hydraulically-operated out-feeding tools in a horizontal head, and chamfered. The third working station provides for drilling the four 18-mm. diameter holes in the front flange. In addition, a vertical spindle *H*, Fig. 1, is applied to bore the internal hole, which subsequently receives a brass seating ring, and to face and recess the top surface of the casting.

Next, the front flange face is machined by out-feeding tools in a horizontal head, while a recessing tool *J*, in the head, which also carries the boring spindle, produces an undercut in the internal bore, for the reception of the seating ring. Before this ring is assembled, the casting passes through a cleaning station seen at *K*, where the swarf is blown out by means of air jets.

At the subsequent assembly station, the previously-machined seating rings are loaded, by the operator, into a vertical tubular magazine *L*, also seen in Fig. 4, from which they are taken in turn by a pivoted carrier *M* and presented to the ram indicated at *N*.

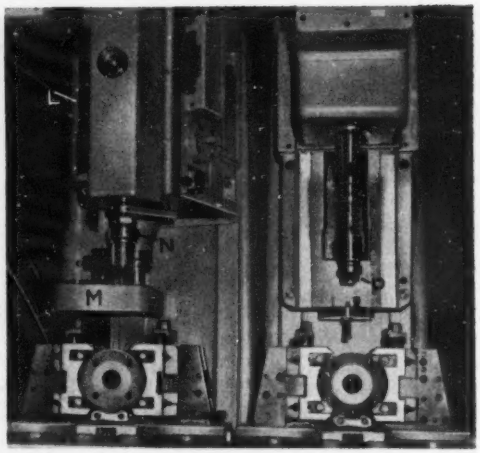

Fig. 4. The Stations for Assembling the Seating Ring and Spinning it into an Undercut in the Bore of the Valve Body

The ram is fitted with a solid centre mandrel, surrounded by a collet-type gripper sleeve which engages the periphery of the seating ring. After the ring has been picked up from the carrier, by a downward movement of the ram, the latter is retracted to allow the carrier to swing back to the magazine ready to receive another ring. The ram then moves down again, to press the sealing ring into the bore of the casting. Spinning, at the next station, is accomplished by means of a 3-roller out-feeding tool *P*, which forces the metal into the undercut formed in the casting bore by the tool *J*, to ensure a firm, pressure-tight joint. After this spinning operation, finish boring and recessing are carried out on the casting, with a vertical head, and, finally, the seating face of the pressed-in ring is faced and chamfered. The work clamps, as previously explained, are then automatically released at the last station (Fig. 3) and the platen is indexed on to the trolley which transfers it to the overhead return runway. The various unit heads are of the screw-feed type, and the driving motors total 75 h.p. To expedite tool changing, fixtures are employed for pre-setting the cutter heads.

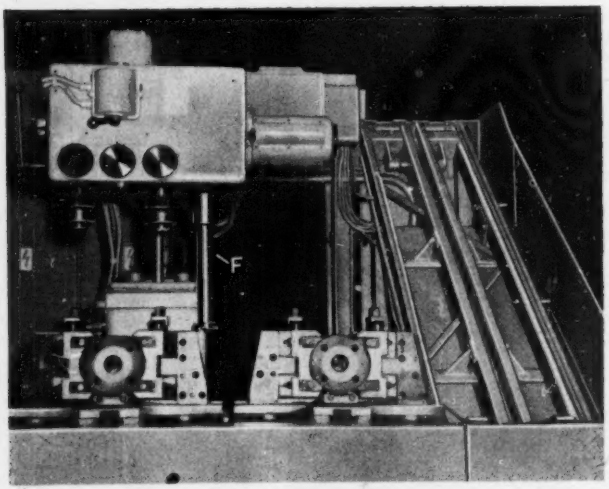

Fig. 3. A View at the Delivery End of the Machine, Showing the Head for Automatically Unlocking the Fixture, and the Inclined Platen Transfer Conveyor

NAUMBURG HONING MACHINES

The products of V. E. B. Werkzeugmaschinenfabrik Naumburg include precision honing machines, and the 2-spindle machine shown in Fig. 5 has recently been developed. It is hydraulically operated and has a capacity for honing bores up to 125 mm. (5 in.) diameter, by 320 mm. (12½ in.) long. Steplessly-variable reciprocating speeds from 7 to 52 ft. per min. are available for the honing spindle, and the rotational speeds, which are also steplessly variable, range from 25 to 150 r.p.m.

There are four stations on the work table, which is indexed through 180 deg., when the start-cycle button is pressed, to bring two workpieces, previously loaded at the outer stations, to the honing position. The machine can be set for finish honing two workpieces, or for rough honing with one spindle and finish honing with the other. A feature of the design is that air gauging equipment is incorporated for controlling hone expansion and for stopping the machine when the required bore size is reached. This size control is effected by means of air jets, which are built into the honing heads and connected to the control units seen on the right-hand side of the machine column.

Fig. 5. Naumburg Type SZX2 x 320 Double-spindle Honing Machine which Incorporates Air Gauging Equipment for Automatic Sizing

To ensure a high surface finish on the work, a magnetic filter is provided, and a thermostatically-controlled cooling unit is also incorporated in the coolant system. In the illustration, the machine is seen set-up for honing the big ends of engine connecting rods, three of which are loaded into each fixture. The bore size is 60 mm. (2·362 in.) and finish honing, to a tolerance of 0·0002 in., is being carried out at both working stations. Approximately 0·001 in. on diameter is removed in a honing time of 45 sec., using diamond grit honing sticks, and an output of 250 pieces per hour is obtained. The honing heads are rigidly mounted on the spindles, and the workpieces, located by spring-loaded pins which engage the small-end bores, are allowed to float in the fixtures. Attention is drawn to the advantages afforded by diamond honing stones, particularly for small diameters, and for parts with blind or multiple bores. Because of the long life of these stones, accurate sizing can readily be maintained on large batches of workpieces, and it is stated, for example, that as many as 60,000 gudgeon pin bores have been honed in aluminium alloy pistons with one set of diamond stones.

The Naumburg range of hydraulic honing machines includes vertical, single-spindle types of various capacities, up to the largest sizes. The type SZ5 55×300, for bores from 8 mm. (0·315 in.) to 55 mm. (2⅛ in.) diameter by 300 mm. (11⅞ in.) long, is of interest in that the main reciprocating motion is applied to the work table, while the honing spindle rotates and is also reciprocated rapidly through a short stroke, which is variable up to 10 mm. (0·4 in). Four reciprocating speeds, namely 500, 710, 1,000 and 1,400 double strokes per min. are obtainable, and the rotational speed of the honing spindle is steplessly variable, by mechanical means, from 35 to 300 r.p.m.

With a capacity for bores up to 500 mm. (20 in.) diameter by 1,900 mm. (6 ft.) long, the largest general-purpose vertical machine has a fabricated steel column and is fitted with a compound work table. For long tubular components, up to 180 mm. (7 in.) bore, a type SZ5×180 vertical machine is being built in various honing length capacities, up to 5,000 mm. (16 ft. 6 in.). The spindle speeds are steplessly-variable from 20 to 180 r.p.m., and the hydraulically-reciprocated honing head moves on two round guides. A 2-station indexing work table, fitted with chucks, is provided at floor level, and the part to be honed is accommodated in a pit. With this arrangement, one workpiece can be loaded while another is being honed.

A 6-spindle vertical, high-production machine

has been developed for honing parts such as cylinder liners, and the range also includes a small horizontal, hand honing machine, for bores from 5 mm. (0·2 in.) to 63 mm. (2½ in.); mechanically- and hydraulically - operated superfinishing heads, and a vertical lapping machine which can be fitted with either cast-iron laps or grinding discs.

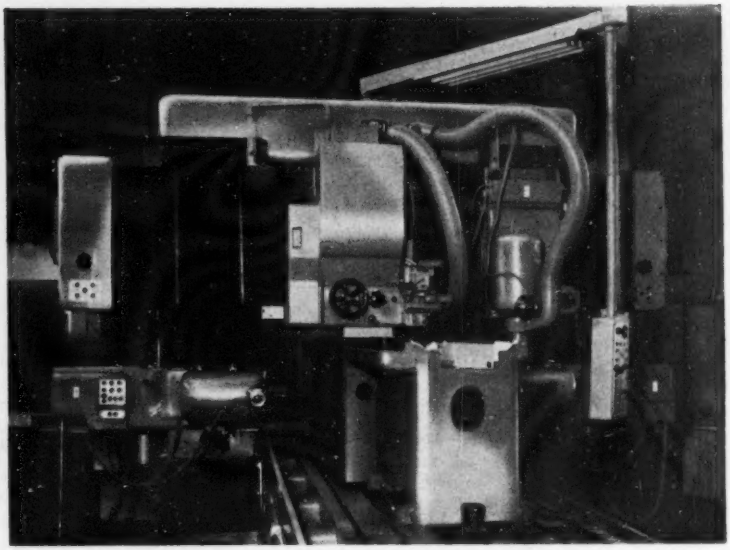

Fig. 6. Aschersleben Double-column Hydraulic Slideway Grinder

DOUBLE-COLUMN SLIDEWAY GRINDER

In Fig. 6 is shown the type SFXFBZ1250 double - column slideway grinder built by VEB Weukzeugmaschinenfabrik Aschersleben. It has a grinding capacity of 49 in. wide by 39½ in. high, and can be supplied in various length capacities from 13 to 33 ft. The table is traversed by means of a hydraulic piston and cylinder, and the speed is steplessly-variable from 10 in. to 82 ft. per min., so that the machine can be used for fine milling as well as the rough and finish grinding operations. Also, with the addition of a high-frequency generator and coil units, the machine can be employed for induction hardening slideways.

The rigid box-section cross rail is provided with power traverse at the rate of 21 in. per minute on the columns, and when the push-button control is released, clamps are automatically applied. Long, narrow guideways are provided on the front of the cross rail for peripheral-wheel and cup-wheel heads, which incorporate rollers to ensure sensitive movements. Rapid traverse is available, both horizontally and vertically, for the grinding heads, and increments of coarse and fine feed can be applied by means of cams. Provision is also made for fine hand feed, and the cup wheel head is arranged to swivel up to 60 deg. on each side of the centre-line. Wheels up to 16 in. diameter by 3 in. wide can be mounted on the peripheral grinding head, and spindle speeds from 1,295 to 1,625 r.p.m. are provided, the drive being taken from a 12-h.p. motor. Three speeds, namely 750, 1,500 and 3,000 r.p.m., are available for the cup wheel spindle, which is driven from a pole-changing motor. Both spindles are mounted in adjustable anti-friction bearings. Horizontally-mounted, swivelling cup-wheel grinding heads, similar in design to that on the cross slide, are carried on the uprights. These heads have rapid traverse both horizontally and vertically, also fine hand feed, and power feed by cam.

A measuring control unit, which operates in conjunction with a full-size template of the work being ground, can be fitted, and the machine can be supplied with dust extraction equipment or a coolant pump unit.

DOUBLE COLUMN JIG BORING MACHINE

Developments by VEB Feinstmaschinenbau Dresden include a new design of double-column jig borer, and a precision thread grinding machine. The jig borer, known as the type BKoZ 800 by 1120, is shown in Fig. 7. It has a 31½ by 39½ in. table with a longitudinal traverse of 39½ in., and the cross traverse of the spindle head is 28 in. Co-ordinate settings are made with the aid of precision screws fitted with correction devices, in conjunction with large-diameter vernier drums, with built-in illumination.

The machine is intended for fine milling in addition to jig boring operations, and for this purpose, steplessly-variable table feeds from 1¼ to 11 in. per min. are provided. Power rapid traverse is available for the table, and for the

spindle head transversely, at the rate of 40 in. per min., and for the cross rail, vertically, at 25 in. per min. To permit sensitive hand adjustment when making co-ordinate settings, the table and the spindle head move on roller guideways, and the precision screws rotate in oil baths. Table clamping, with constant pressure, is effected by hand, and the clamps for the spindle head and cross rail are operated electro - mechanically. Workpieces weighing up to 16 cwt. can be carried on the table.

The boring spindle has a stroke of 10 in., and steplessly-variable feeds from 0·0008 to 0·31 in. per min.

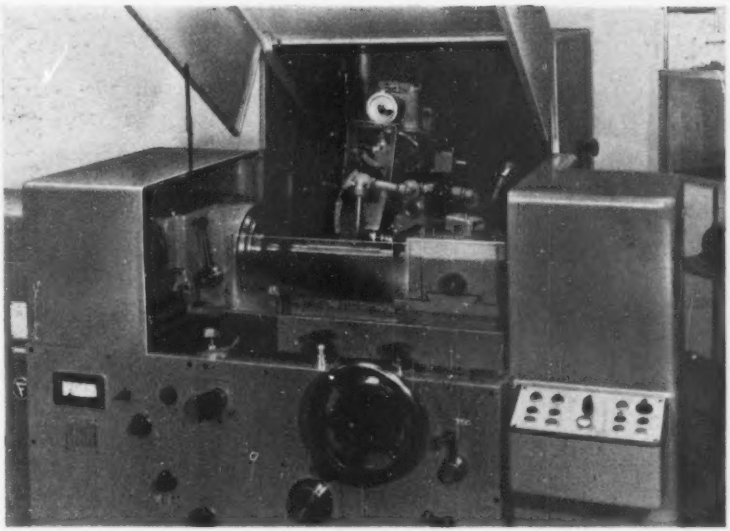

Fig. 8. The Type GSA 250 x 250 Thread Grinder Developed by VEB Feinstmaschinenbau Dresden

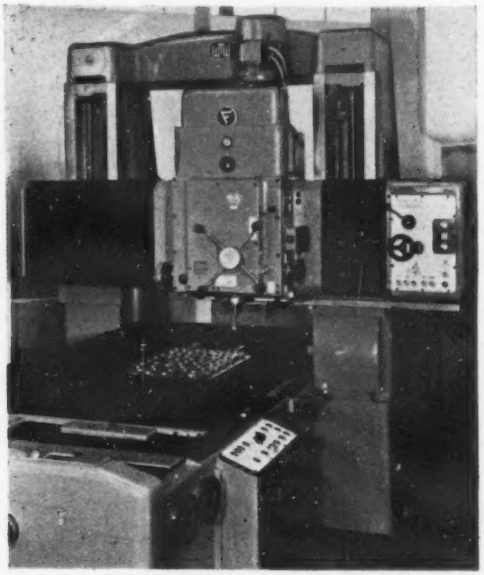

Fig. 7. Double-column Jig Borer Introduced by VEB Feinstmaschinenbau Dresden. Co-ordinate Settings are Made by Means of Precision Screws Fitted with Correction Devices

are provided. The spindle speeds are also steplessly variable, and there are three ranges, from 28 to 112 r.p.m., 100 to 400 r.p.m., and 355 to 1,400 r.p.m. In addition, there is a slow speed of 3 r.p.m., for use when setting up. Drive to the spindle is taken from a motor of 3½ h.p. The controls for the machine are conveniently centralized on panels, on the right-hand side of the bed and cross rail, and some of them are duplicated in a further panel on the opposite side of the bed.

PRECISION THREAD GRINDING MACHINE

The type GSA 250 × 250, thread grinding machine, which has been introduced by VEB Feinstmaschinenbau Dresden, is illustrated in Fig. 8. It will grind threads from 0·080 to 10 in. diameter, and of 10 in. maximum length. Either single or multi-rib wheels can be used, and the machine is designed for both traverse and plunge grinding. To ensure maximum accuracy, the lead screw is located in line with the work spindle and a linear corrector is incorporated. With a screw of 6-mm. pitch, thread pitches from 0·5 to 60 mm. can be ground.

The grinding head can be swivelled through 20 deg. to the right and left for setting to the thread helix angle, and both diamond dressing and

crush forming attachments are fitted. For crush forming, a slow speed of 100 r.p.m. is provided for the wheel spindle, and there are three grinding speeds, namely 1,680, 1,920, and 2,200 r.p.m. The maximum diameter of grinding wheel that can be employed is 16 in. Steplessly-variable speeds from 0·08 to 40 r.p.m. are provided for the work spindle by a D.C. motor drive, and there is a rapid reverse speed of 55 r.p.m.

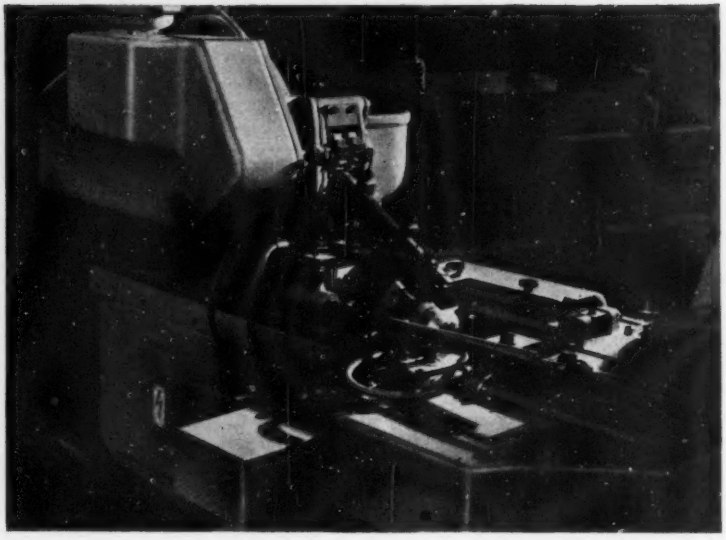

Fig. 10. Type PABF10 Hopper-fed Bolt Head Trimming Machine

COLD HEADING AND THREAD ROLLING MACHINES

VEB Kaltverformungsmaschinenwerk, with works at Karl-Marx-Stadt, demonstrated several recently-developed machines for the production of bolts, screws and rivets. Fig. 9 shows the type PAZM10 solid die, double-stroke, cold-heading machine, which will take stock up to 10 mm. (0·4 in.) diameter and has a maximum cut-off length of 112 mm. (4·4 in.) It is of a generally conventional type, and is driven by a 15-h.p. motor at steplessly-variable speeds which enable outputs from 56 to 75 pieces per min. to be obtained. Stock passes through a 7-roller straightening unit before it enters the feed rolls. The enclosed drive to the crankshaft may be noted, also a centralized one-shot lubrication system for the important bearings and slideways. Known as the Hydrolift, the stock reel unit seen on the left, has been introduced to facilitate the handling of heavy coils of wire. The holder for the coil is mounted on a vertical, sliding carriage, which is connected by cable to the piston of a hydraulic cylinder, and is raised from the loading to the working position by means of a foot-operated pump.

Fig. 9. Type PAZM10 Solid Die, Double-stroke Cold Heading Machine

For use in conjunction with this double-stroke cold header, the type PABF10, automatic, hopper-fed, bolt head trimming machine, seen in Fig. 10, has been developed. It will handle bolts from 7 to 10 mm. (0·276 to 0·4 in.) diameter, up to 4 in. long, and four operating

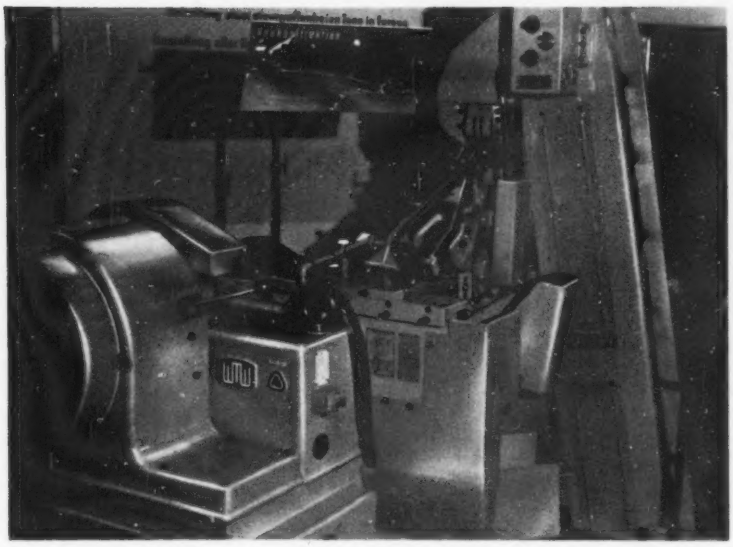

Fig. 11. Type GWB10 Flat Die Thread Rolling Machine Arranged to Roll a Thread at Each Stroke of the Die Slide

speeds, namely 45, 56, 71, and 90 strokes per min., are available.

The type GWB10, fully-automatic, flat-die, thread rolling machine, shown in Fig. 11, which has been introduced by the same company, is provided with a double-channel feed hopper and is arranged to thread roll a workpiece at each stroke of the die slide. It has a capacity for rolling threads up to 2⅝ in. long on bolts from 8 to 10 mm. (0·31 to 0·4 in.) diameter, with a maximum length under the head of 3⅛ in., and the double feeding arrangement enables outputs up to 140 pieces per min. to be obtained. The magazine feed mechanism incorporates means for rejecting any oversize or faulty blanks, and to permit continuous operation, a vertical slot-type elevator, as seen on the right, is provided, which lifts bolts blanks from a large bin and delivers them into the overhead hopper on the machine. The drive to this elevator is taken from a small motor through V-belts and a gearbox, which provides nine delivery speeds. A centralized lubrication system is incorporated for the principal bearings and slideways. The coolant, supplied by a pump, is passed through a magnetic filter before it is re-circulated. A motor of 15 h.p. provides the main drive.

EXPANDED METAL FORMING PRESSES

High-speed, special-purpose presses for the production of expanded metal, which incorporate a number of patented features, are being made by VEB Werkzeugmaschinenfabrik Zeulenroda. Two sizes of press have been developed, and the smaller, known as the type PKZSM 1 × 500, is shown in Fig. 12. It is rated at 10 tons, and will handle coiled strip or sheet material up to 1 mm. (0·040 in.) thick, and from 5 to 20 in. wide. Ram speeds of 265, 375, 530 and 750 strokes per min. are provided, and the increments of feed for the material, determined by interchangeable cams, range up to 4 mm. (0·16 in.) Mesh widths from 1 to 12 mm.

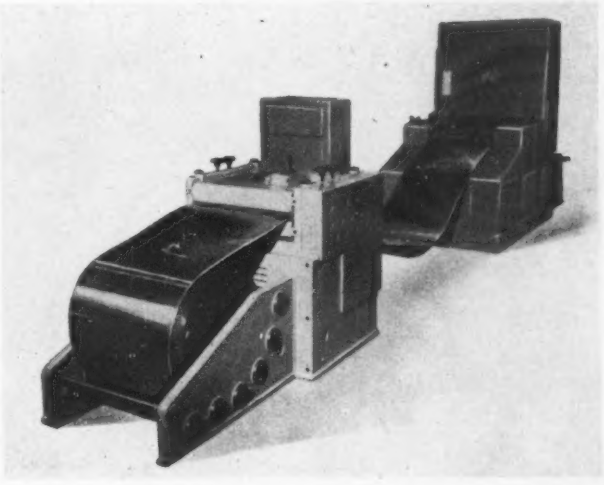

Fig. 12. Zeulenroda Type PKZSM 1 × 500 Expanded Metal Forming Press

(0·040 to 0·48 in.) can be produced in steel, brass, and light alloy sheet, for example, also in synthetic materials. The drive is provided by a motor of 5 h.p., and a power-driven take-off and straightening roll unit, as shown, can be supplied, also a wind-on reel. It is stated that outputs up to 300 ft. of expanded metal per hour can be obtained from this press.

The larger machine, type PKXSM 2 × 1000, of 25 tons capacity, will handle sheet or coiled material up to 2 mm. (0·080 in.) thick by 40 in. wide, and mesh widths from 2 to 62 mm. (0·080 to 2⅞ in.) can be obtained. Feed increments for the material are steplessly variable up to 10 mm. (0·040 in.), and ram speeds of 120, 180, and 250 strokes per min. are obtainable. Hydraulic features are incorporated in the drive.

HEAVY-DUTY UNIVERSAL GEAR HOBBING AND MILLING MACHINE

Built by VEB Zahnschneidmaschinenfabrik Modul, Karl-Marx-Stadt, the heavy-duty universal gear hobbing machine shown in Fig. 13 will handle workpieces up to 80 in. diameter, with pitches up to 20 module (1¼ D.P.). Helical gears up to 45 deg. angle can be cut, and provision is made for hobbing worm wheels by the tangential feed method. In addition, the machine is designed for cutting, on a fully automatic cycle, external and internal spur and helical gears by the indexing method, using either disc-type or end milling cutters. Herringbone gears can also be cut by means of an end mill, and the cycle is then semi-automatic. A hydraulic backlash eliminator is incorporated for the vertical screw and nut of the hob spindle saddle, so that either climb or conventional cutting can be carried out.

Hobs and milling cutters up to 11 in. diameter can be used and there are 18 spindle speeds from 14 to 100 r.p.m. The end milling attachment provides 24 speeds, from 45 to 630 r.p.m. Eighteen rates of feed, with a range sufficient to cover the various applications of the machine, are available radially, tangentially and vertically, and the cutting cycle can be pre-set by means of punched cards and an electric programme control system. The main drive is taken from a motor of 18 h.p.

Automatic hydraulic clamping is provided for the saddle column on the bed, and it may be noted that a hydraulic relief system is incorporated which comes into operation automatically to take the weight of the column during the traverse movements. The load on the table guideways is also relieved hydraulically, and the table has a capacity for workpieces weighing up to 10 tons.

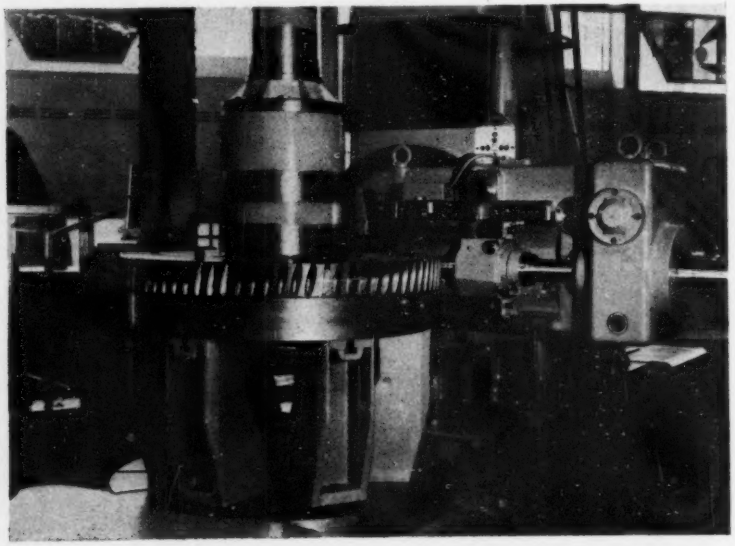

Fig. 13. Modul Type ZFWZ 2000 x 2 Universal Gear Hobbing and Milling Machine

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MOTOR WITH WIDE SPEED VARIATION. It is reported by Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17, that they are to supply a 17½/25-h.p., 1,000 r.p.m. main motor for a milling machine which is to be installed by the Department of Scientific and Industrial Research at the East Kilbride research laboratory.

This motor will be arranged for speed control by means of a magnetic amplifier to ±0·1 per cent of the maximum speed over the full range, regardless of any variations which may be present in load or supply. The milling machine is to be used for a series of experiments to investigate the machining characteristics of various metals.

Production of Thin Metal Parts by Photo-etching

By G. R. HOCKMEYER*

Although photo-etching is by no means a new process, it is only comparatively recently that it has been applied to the production of components of the type here considered. Thin, flat metal parts of intricate shapes are easily made by this method. Moreover, the process is especially economical for short runs and product development work. Typical photo-etched parts produced by the Randolph Co., Houston, Tex., U.S.A., for use in optical, electronic, and electro-mechanical instruments are shown in Fig. 1.

First, a large ink drawing of the desired part is prepared. This drawing is then photographed so as to produce a full-size negative which is used to make a number of positives on a sheet of film. The positive images on this film are contact-printed on to sheets of sensitized metal which may range in thickness up to 0·016 in. During the etching operation which follows, the developed images protect the metal from the action of the acid solution while the surrounding metal is dissolved. No burrs are left on the workpiece and no strain is set up in the metal. Limits of the order of ±0·002 in. can be maintained.

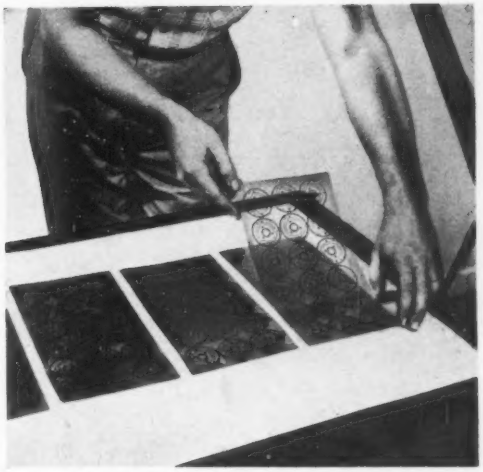


Fig. 2. The Film Positives and the Sensitized Metal Sheets are Clamped in a Vacuum Contact-printing Frame and Exposed to an Arc Lamp. A Single Film can be Used Hundreds of Times

A typical application of the process is for making springs for an electronic device, known as a geophone, which is used to detect sub-surface reflections when prospecting for oil by the seismic method. The springs are usually made from beryllium copper and are of ¾ in. to 2¼ in. diameter and 0·003 to 0·012 in. thick. This material, which can be heat-treated to a spring temper, has excellent etching properties. A spring usually consists of an inner and an outer ring connected by three integral strips. The design of the connecting strips and the thickness of the material determine the frequency response of the geophone. Although the frequency can be calculated in advance, the design of the spring is obtained largely by trial and error.

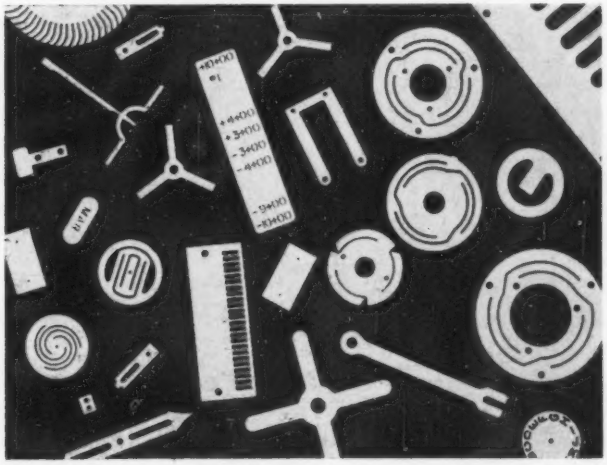


Fig. 1. Examples of Parts Produced for Optical, Electronic, and Electro-mechanical Instruments by the Photo-etching Process

* Randolph Co., U.S.A.

Fig. 3. After the Sheet has been Etched in Hot Aerated Ferric Chloride, the Protective Coating is Removed with a Solvent and the Parts are Lifted off the Masking Tape

In practice, about a dozen springs are photo-etched on the basis of preliminary calculations. After installing these springs in geophones, the frequency and other properties, such as life expectancy, are determined. If necessary, the master drawing is then modified and new samples are quickly produced.

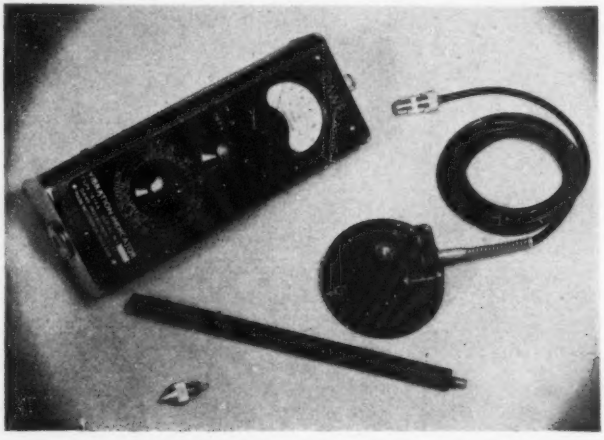
The proper design may be determined after one or two trials, but in some instances as many as ten modifications have been found necessary before the optimum compromise between frequency and spring life was achieved. In either case, such a trial and error method is practical and economical when the photo-etching process is employed. The expenditure for producing this particular part was less than 50 dollars and the cost of each spring was about 20 cents.

After the beryllium copper sheets have been sprayed with the sensitized coating, they are exposed only to subdued light to prevent fogging. The film positives and the sensitized metal sheets are clamped in a vacuum contact-printing frame, as seen in Fig. 2, and exposed to an arc lamp. A single film can be used hundreds of times. After exposure, the sheets are immersed in a developer, and acid-resistant paint to resist etching, and masking tapes to prevent loss, are applied to the rear of each sheet. Etching is carried out in hot aerated ferric chloride which is violently agitated. Next, the protective coating is removed with a solvent, and the parts are lifted off the masking tape as seen in Fig. 3. Final cleaning is carried out in a vapour degreasing plant.

Dawe Type 1414 Vibration Indicator

The type 1414 vibration indicator shown in the accompanying illustration has been developed by Dawe Instruments, Ltd., 99 Uxbridge Road, London, W.5, and is a light portable unit intended primarily for the location of sources of vibration. Of the inertia-operated crystal type, the vibration pick-up delivers a voltage proportional to the acceleration of the object with which it is in contact. A meter is incorporated which gives a direct reading of the peak acceleration, up to a maximum value of 3,800 in. per sec.^{2} (approximately 10 g). Two separate circuits are provided for measuring the velocity and displacement of the vibration, and these can be used singly, or combined.

The unit measures 8¾ by 3¾ by 2⅞ in., weighs 2½ lb., and is operated by built-in H.T. and L.T. dry batteries. An 8-in. extension probe is supplied for use in locations which would otherwise be inaccessible.



Dawe Type 1414 Vibration Indicator with Pick-up and Extension Probe

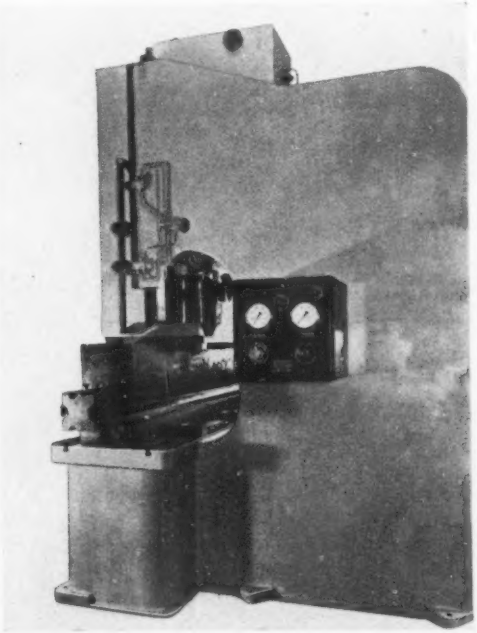
New Production Equipment

Hugh Smith 250-ton, Fully-guided, Hydraulic Gap Press

The accompanying figure shows a 250-ton hydraulic gap press which was recently built by Hugh Smith & Co. (Possil), Ltd., Glasgow, and supplied to Federal Springs, Ltd., New Zealand. It has a 30-in. deep gap, and the moving table and ram are fully guided, even at the bottom of the 18-in. stroke, so off-set loading is avoided. The work table is 8 ft. long and is provided with flanging and forming tools of this length.

As the double-acting ram is relieved entirely of side pressure, it is of fairly small diameter to suit the working pressure of 2,800 lb. per sq. in. Towler Bros. pump and valve equipment is employed, together with their Autodraulic automatic cycle control. The rated speed of operation is 10 strokes per min. on 1½-in. stroke, including ⅝ in. at pressing speed. When the press is operated by hand control, the approach speed is 3 in. per sec., the pressing speed 0·3 in. per sec., and the return speed 4·4 in. per sec. Drive is provided by a 20-h.p. motor, and all the pumping equipment is housed within the main frame, but readily accessible through an opening at the rear.

The box-section cross-head is designed to ensure maximum rigidity, and is guided on graphite-impregnated Formapex of generous area, which has good wearing qualities when used with steel. In this press, the number of hydraulic packings has been reduced to two, and they are of the latest Hallprene type.



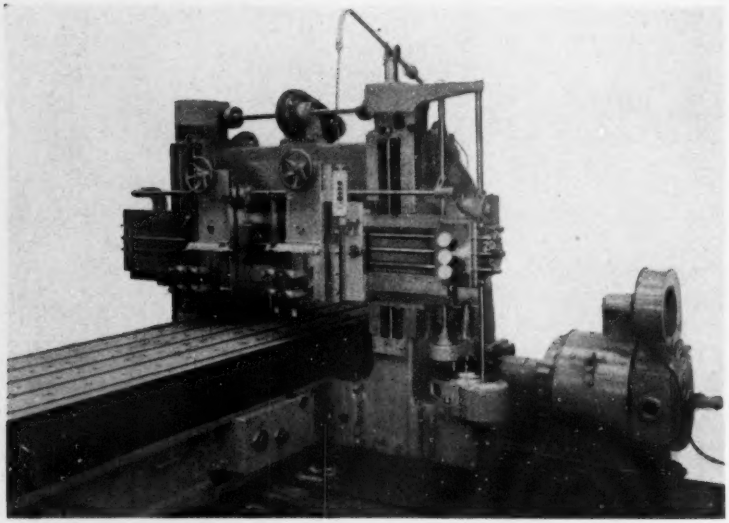
Hugh Smith 250-ton, Fully-guided, Hydraulic Gap Press

Ward, Haggas & Smith Rail Planing Machine

The accompanying figure shows a rail planing machine which was built recently by Ward, Haggas & Smith, Ltd., Parson Street, Keighley, for the Nigerian Railways. Work up to 54 in. wide is admitted between the housings, and up to 24 in. deep, under the cross-rail, and the 21-ft. long box-section bed has flat ways for the table, and is fitted with automatic lubricators. The centre portion of the bed is extended to 13 in. below the level of the floor, to give a total depth of 36 in.

Box-section housings are tongued and bolted to the bed and connected at the top by a cross-beam. Wide bearing faces for the cross-slide, which is 20½ in. deep, are provided on the standards. The cross-rail is of deep box-section at the rear, and is raised and lowered by power, balance weights being provided within the housings. Two large tool-boxes are fitted and each carries holders for two tools.

Automatic feeds in the horizontal and vertical directions are provided by a friction feed box at the near side of the machine, and are adjustable



Ward, Haggas & Smith Rail Planing Machine for the Nigerian Railways

from 2½ to 54 cuts per in. There are hand adjustments for all tool-box movements, and mechanical tool lifters are fitted.

Of massive proportions, the T-slotted table measures 12 ft. long, 42 in. wide and 8¼ in. deep, and carries a spring-loaded sliding rack cut from a solid steel slab. Drive is taken from a 50-h.p. motor, which operates on the Ward-Leonard system, and gives cutting speeds from 15 to 40 ft. per min., and return speeds up to 80 ft. per min. Steel gearing is employed, throughout, and the main drive gears are of the double-helical type, apart from the bull wheel and rack. The approximate weight of the machine is 27 tons.

Grimston Electriska AEC48 Drilling Machine

The accompanying illustration shows the latest addition to the range of all-geared drilling machines made by Grimston Electric Tools, Ltd., Progress Way, Purley Way, Croydon. This machine has a maximum drilling capacity of 1¼ in., and eight spindle speeds ranging from 51 to 1,300 r.p.m., drive being taken from a 0·90-h.p. built-in electric motor. The drilling spindle has a traverse of 6 in., and there are four power feeds ranging from 0·0055 to 0·0105 in. per rev. A clutch and automatic trip mechanism, which can be set in relation to a graduated scale, are incorporated.

The drilling head can be swung about the 4¾-in. diameter portion of the column, and can be adjusted vertically on the latter by means of a rack and pinion. Carried on the 5¼-in. diameter lower portion of the column is the support bracket for the work-table, and this bracket can be moved on the column in a similar manner to the drilling head. The 18- by 18-in. T-slotted work-table is pivot-mounted on the support bracket, and can be rotated through 240 deg., provision being made for locking it in the required position. Two additional T-slots are provided in an extension which is cast

Grimston Electriska AEC48 Drilling Machine

integral with the work-table on one side. T-slots are also provided in the base plate, and a self-contained motorized coolant pump and tank unit, as seen standing at the rear, can be supplied as an extra. The maximum distances obtainable from the spindle nose to the work-table and base are 28 in. and 48 in. respectively, and the minimum distance for the latter is 37½ in.

Denham SR8V 16-in. Centre Lathe

Denham's Engineering Co., Ltd., Holmfield, Halifax, have recently incorporated a number of design improvements in their SR8V, 16-in., centre lathe, and a view of this machine is given in Fig. 1. The bed now has diagonal cross-ribbing, to provide additional rigidity, and sole plates with levelling screws and foundation bolts are fitted. Slide rails, attached to the left-hand sole plate and the bed, are provided for the driving motor, and the amount of floor space required is consequently reduced. Push-buttons controlling the driving motor for high-speed, low-speed, stop and reverse are carried in a control panel mounted on the front face of the headstock, as are the buttons for the coolant pump. The covers for the V-ropes and the gearing of the left-hand end of the headstock have been redesigned, and improved coolant splash guards are fitted.

The spindle is bored to pass a 2¼-in. diameter bar, and twelve speeds are provided which may range from 1,200 to 44, 900 to 33, or 600 to 22 r.p.m., where the drive is taken from a single-speed, 10-h.p. motor. If a 2-speed, 10/5-h.p. motor is used, the spindle speeds range from 1,200 to 22 r.p.m. A number of accessories can be supplied, including a hydraulic copying attachment. In its standard form, as seen in Fig. 1, the machine will admit up to 9 ft. between centres.

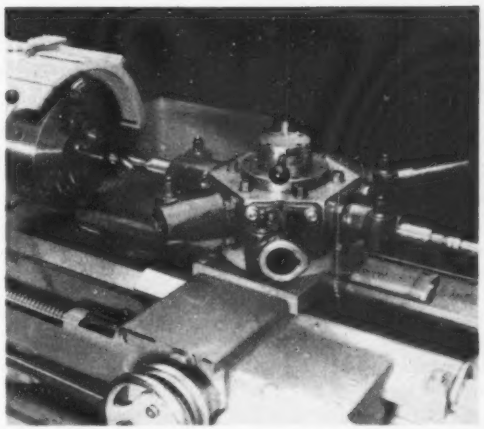


Fig. 2. Close-up View of the Denham SR8V Centre Lathe Fitted with a 6-station, Heavy-duty Turret

Alternatively, the machine can be supplied with a 6-station, heavy-duty, turret, as shown in the close-up view, Fig. 2. This turret is arranged for precision indexing, is provided with a quick-action plunger for location at the various stations, and is intended for use with Ward 7 combination tool-holders. A maximum of 24-in. is admitted between the chuck and the faces of the turret, the longitudinal traverses can be controlled by automatic trip stops and the cross-traverse by dead-stops.

A third version of the SR8V lathe has also been developed which is in effect a simple type of combination turret lathe. Basically the same as the machine shown in Fig. 2, it is equipped with an additional turning and parting-off saddle with a heavy-duty square turret. A specially-extended cross-slide, with a T-slotted face for

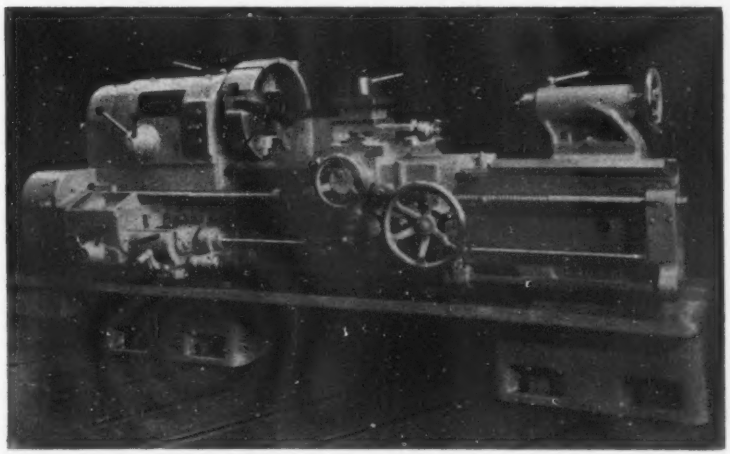


Fig. 1. Denham SR8V 16-in. Centre Lathe

a rear tool-post, is also available. On this machine the 54 longitudinal feeds for the turning saddle range from 0·250 to 0·004 in., and the facing feeds from 0·040 to 0·0007 in.

Churchill-Redman 14- by 40-in. Automatic Hydraulic Profiling Lathe for Cylinder Liners

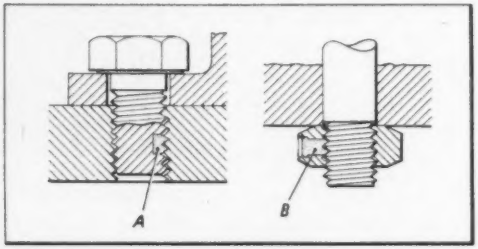
Churchill-Redman, Ltd., Parkinson Lane, Halifax, have recently built the 14- by 40-in. automatic hydraulic profiling lathe, shown in the figure, for machining cast-iron cylinder liners of various sizes. In place of the normal tailstock, an extended carriage, with a large bearing area, is mounted on the bed. A boring bar holder is located by a tenon on the carriage and can be positioned longitudinally, and a special steady for the boring bar is mounted on the rear slide of the machine.

There are two hydraulically-operated tool-slides on the rear slide, which are brought into operation automatically. One of the slides carries the grooving and facing tools, and the other a parting-off tool. The outside diameter of the cylinder liner is profile-turned from a plate template by a tool-slide on the carriage, while the boring bar tool is in operation. Special steady pads are provided for the boring bar to ensure accuracy and concentricity. The component is gripped in a 12-in. diameter, 3-jaw, wedge-type, hydraulically-operated chuck, which is controlled by means of a pedal.

A Warner electric clutch and brake are incorporated in the headstock, which is arranged for push-button operation, instead of the normal control by lever. Advantages claimed for this system are that the main drive clutch does not need adjusting during the life of the clutch plates, and that the spindle brake permits rapid stopping from high speeds.

G.K.N. Wedglok Self-locking Nuts and Bolts

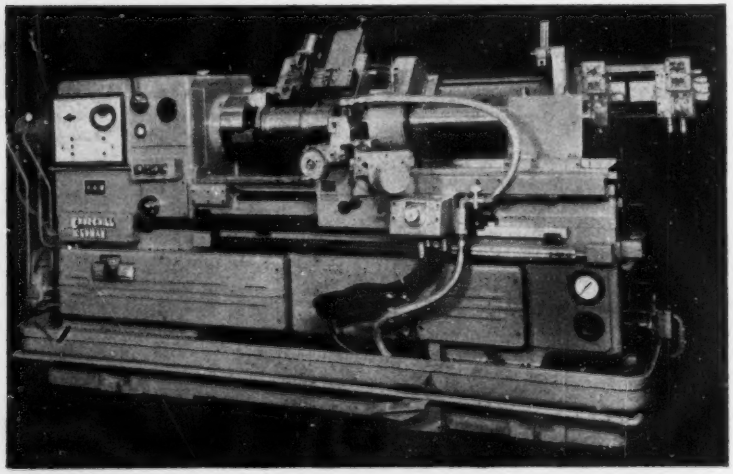
A range of vibration-proof nuts, bolts, and screws is being manufactured, and marketed under the name Wedglok, by Guest, Keen & Nettlefolds



The Method of Self-locking by Means of a Nylon Plug which is Used for the Range of G.K.N. Wedglok Fasteners

(Midlands), Ltd., Screw Division, Box No. 24, Heath Street, Birmingham, 18, and the accompanying drawings show part sections through a screw and nut incorporating the patented self-locking arrangement.

The locking element consists of a tough, resilient nylon pellet, which is inserted in the threaded portion of a bolt, nut, or screw. In the drawing at the left can be seen a bolt with the nylon pellet indicated at A, and it will be noted that the presence of the nylon has forced the bolt laterally, to the left, so that a wedging action takes place in all the threads on the left-hand side. The unit seen at the right, has a nylon



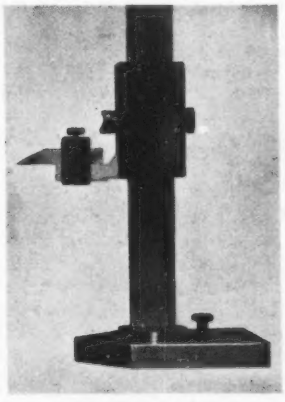
Churchill-Redman 14- by 40-in. Automatic Hydraulic Profiling Lathe for Cylinder Liners

pellet *B* inserted in a hole drilled through one of the flats, and a similar wedging action takes place. It is claimed that nuts and bolts incorporating these inserts are self-locking, whether seated or not.

The nylon pellets are unaffected by temperatures between −70 deg. and 250 deg. F., may be used under water, and are resistant to most commercial solvents, alcohol, petrol, oil, and boiling 40 per cent caustic soda. As the nylon is resilient, it tends to resume its former shape after it has been removed from a thread, so that fasteners can be used again. Wedglok fasteners are available in a large range of types and thread forms.

Huddersfield Rigid Beam Height Gauge

In the accompanying figure is shown the rigid beam height gauge which has recently been introduced by Huddersfield Gauges, Ltd., Waterloo, Huddersfield. It is made in a range of sizes for measuring heights from 12 to 72 in., and is noteworthy for its rigid construction and the provision for rapid and simple coarse and fine adjustment of the sliding jaw. Rigidity is, of course, of particular importance for the larger instruments.



Front View of the Huddersfield Rigid Beam Height Gauge

The vertical beam is of channel section, and the greatest moment of inertia of the cross-section is so disposed as to resist deflection due to pressure of the scribing point on the workpiece. The sliding jaw, which carries the scriber, can be accurately adjusted by engaging a half-nut with a square-thread screw housed in the channel at the rear of the beam, and rotated by means of a knurled knob on the base or another knob at the top of the beam.

Initially, the sliding jaw is moved by hand to the approximate coarse adjustment position required, the half-nut being disengaged from the screw by means of a spring-loaded plunger. All measuring faces are hardened, ground and lapped.

The vernier scales conform to B.S.S. No. 887/1950, at 68 deg. F., and are of much greater length than normal, so that accurate settings can be made without the aid of a watchmaker's glass. These scales give readings to 0·001 in. and 0·02 mm. Accidental displacement of the vernier scales, is prevented by the design of the sliding jaw.

Zero and depth rod attachments are available for use with the instrument.

Sommerfield Type L.D.6A. Sandblast Stencilling Cabinet

In the figure is shown the type L.D.6A sandblast stencilling cabinet, which has recently been placed on the market by H. G. Sommerfield, Ltd., 8 Camden Road, London, N.W.1.

Occupying a floor space of only 24 by 12 in., this equipment has an overall height of 36 in., and at the top there is a stencil holder of flexible material which will conform to the shape of contoured parts. Marking is carried out by bringing the workpiece into contact with the stencil, and depressing a spring-loaded pedal which operates a valve for controlling the compressed air supply to the blast gun.

Owing to the fact that there are no projections at the top of the cabinet, components with large surface areas may be conveniently handled. The

Sommerfield Type L.D.6A Sandblast Stencilling Cabinet

cabinet may be used to advantage for marking certain metal parts for aircraft where stressing must be avoided.

The blast gun is mounted on a hinged panel at the front of the cabinet, so that it can readily be swung clear for adjustment and maintenance. A second hinged panel affords access to the hopper for the abrasive material and to the feed-adjusting arrangement.

A built-in dust extraction system, with a push-button controlled ¼-h.p. driving motor, is provided, which is specially arranged to prevent the escape of very small dust particles to the atmosphere. If required, a detachable visor can be provided, which is adjustable for angle. Spent abrasive and debris is delivered to a bag, which is emptied by a shaking action applied to a conveniently-placed lever. The debris is then directed into a drawer at the bottom of the cabinet.

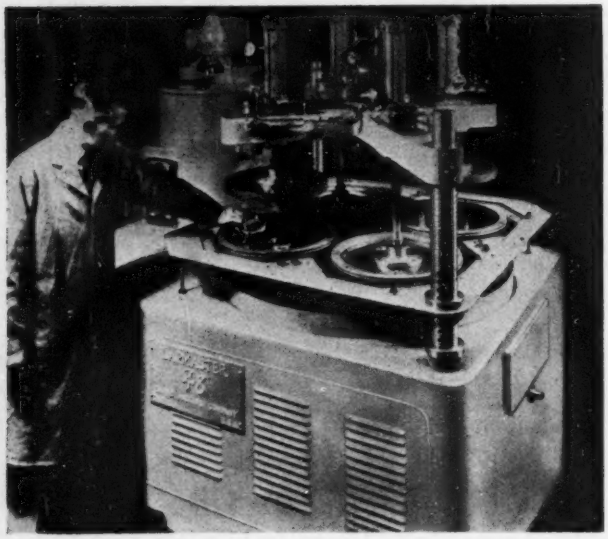
Lapmaster 48-in. Flat Lapping Machine

The range of British-built Lapmaster flat lapping machines distributed by Payne Products International, Ltd., Lawrence Estate, Green Lane, Hounslow, Middlesex, has recently been extended to include the 48-in. machine here illustrated.

Four combined work holding and conditioning rings are provided, which are retained by roller bar attachments secured to a fixed top plate. With this arrangement, the rings can rotate freely under the action of the revolving lap, which is thus continuously conditioned when the machine is in operation. The conditioning rings have 17-in. diameter bores which enable, for example, a total of 940 parts of 1-in. diameter to be handled simultaneously. The pressure plates are raised clear of the rings, to enable workpieces to be loaded and unloaded, by air cylinders which are mounted on a cruciform carrier supported by columns. If required, the air cylinders can be arranged to raise the conditioning rings clear of the lap.

Lapmaster machines are stated to permit workpieces to be lapped to an accuracy of 1 light band (0·0000116 in.) for flatness, and to a surface finish of 1 to 5 micro-inches. They will handle parts of steel, Monel, Stellite, brass, aluminium, glass, carbon, plastics and ceramics, and are extensively employed for precision lapping components for motor car engines and transmissions, adding machines, cameras, and projectors, also tool and die parts.

British-built Lapmaster machines, are also available in 12-, 24- and 36-in. sizes.

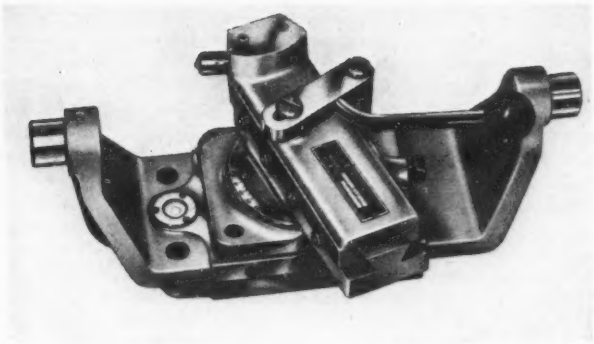


Lapmaster 48-in. Flat Lapping Machine

Endia Type ADS.920 Angle and Relief Dressing Fixture

The Endia type ADS.920 angle and relief dressing fixture shown in the accompanying illustration has recently been added to the range of wheel dressing equipment made by Engineering Diamonds, Ltd., 26 Warwick Row, Coventry. This fixture is intended for use on cylindrical grinding machines for dressing angular faces on wheels for taper grinding, also for relieving the sides of the wheel when it is required to grind shouldered components.

The equipment comprises a swivelling dovetail slide, which is spigot-mounted on the rectangular base and can be set for angle with reference to an integral protractor. A clamp is provided for locking the slide in the required angular position. The front and rear edges of the rectangular base are accurately ground in relation to the zero mark on the protractor scale, and may be used as a datum for aligning the fixture with the grinding machine. Two angularly-disposed holes are provided, to receive the diamond holder, in the head of a 6-in. long, lever-operated slide, which has a



Endia Type ADS.920 Angle and Relief Dressing Fixture

stroke of 2 in. The base measures 3½ by 4½ in., and the height from the base to the diamond is 2⅝ in.

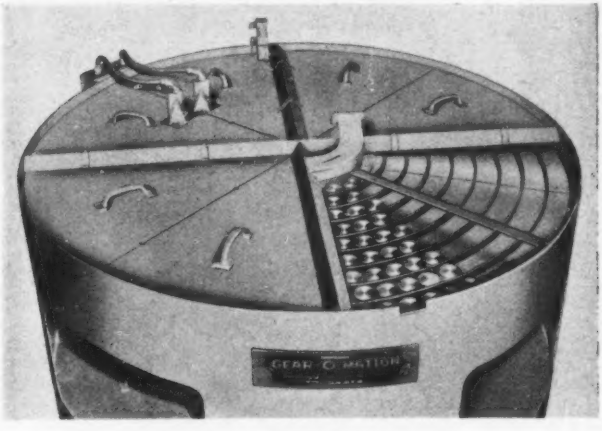
In the illustration, the fixture is shown mounted on the type B.921 base, which enables the unit to be supported on the machine between centres. This base, which is 12 in. long, incorporates a spirit level, to facilitate setting the unit horizontally, and there are two plain holes at the left for ½-in. diameter support bars, which can be inserted to contact any convenient surface on the machine.

Gear-O-Mation Storage Unit

The storage unit shown in the figure has been introduced by the Gear-O-Mation Division, Michigan Tool Co., East Detroit, Michigan, U.S.A., who are represented in this country by Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11.

With this equipment, a bank of partly-machined components can be maintained in an automatic production line, and they may be delivered as required for the next operation. Although primarily intended for handling spur gears, the unit may be employed for storing other components which may be of irregular shape. It comprises, essentially, two disc-shaped storage platforms which are rotated, and non-moving spiral guide rails. Each platform will accommodate about 300 workpieces, and the arrangement enables components with a good surface finish to be handled without risk of damage.

Workpieces are loaded on to the upper platform, near its centre, by way of a chute. Due to the rotation of the platform, the components are passed between the turns of the guide rails, and, at the same time, are moved radially outwards. From the periphery of the upper platform, the parts are transferred in turn, by gravity, to the centre of the lower platform, and are again moved radially outwards for discharge from the unit.



Gear-O-Mation Work Storage Unit

A NEW TAPPING FLUID.—A new tapping fluid has been introduced by Amber Oils Ltd., 11A, Albemarle Street, London, W.1, and is known as A.P. Cutting Fluid. It is an extreme pressure coolant, with unusual penetration properties, and was originally produced for tapping armour plating, but has since been applied to very high tensile materials, including Nimonic.

An aircraft manufacturer reports that, when tapping S.99 and S.110 materials, the taps were reground several times each day. When A.P. Cutting Fluid was used, however, each tap lasted several days before regrinding was necessary, and breakages were eliminated.

Although the cost of the new fluid is high, this is more than offset by the savings in tool costs and the elimination of production delays. Furthermore, the fluid, which is applied by brush, is very economical in use.

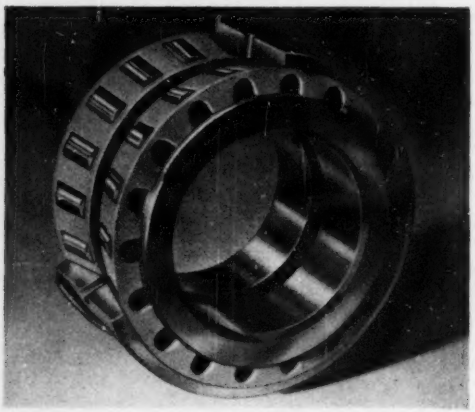
Gamet Taper Roller Bearings

Gamet "Micron Precision" taper roller bearings are now being manufactured by Gamet Products, Ltd., Hythe, Colchester, in both single and double row types, each with plain and flanged outer rings, in a range of sizes covering bore diameters from 35 to 210 mm. Designed and manufactured primarily for use on machine tool spindles where a high degree of accuracy coupled with rigidity and cool running over a wide range of speeds is demanded, these bearings are finding other applications where similar characteristics are necessary, for example in printing machinery, and the manufacturers offer a technical service to users. A view of a cut-away double-row bearing, showing the cage construction, is given in the accompanying figure.

The following are the guaranteed manufacturing tolerances: radial bore run-out 0·001 mm. (0·00004 in.); side run-out 0·004 mm. (0·000157 in.), and relative bore run-out (for double row bearing) zero.

Amongst the features of these bearings are the hollow rollers which, together with the special cage construction, ensure that full use is made of the oil flow for lubricating and cooling purposes. A light alloy cage, the surface of which has oil retaining properties, is employed and almost entirely encloses the rollers, occupying practically the whole space between the inner and outer rings. The cage is centred on the inner ring and allows only a small proportion of the oil to flow along the bearing tracks for lubrication purposes. Oil may be introduced into the bearing in quantity, and, on passing through the hollow rollers, cools and lubricates their faces. By this means, churning and centrifugal pumping action are eliminated. The temperature gradient from inner ring to outer ring is thus reduced, and the bearing can function over a wide speed range without re-adjustment.

The roller and track angles are lower than those used in standard taper roller bearings, and, while they provide adequate thrust capacity, ensure comparatively low pressure on the retaining flange. In addition, the proportions of the rollers have been carefully studied to prevent skewing, which can otherwise be a source of heating and inaccurate rotation. The outer rings are of large cross sectional area, and are intended for assembly with non-interference fits, so that distortion is avoided, and installation and removal are facilitated. Simplicity of adjustment is another feature claimed for these bearings.

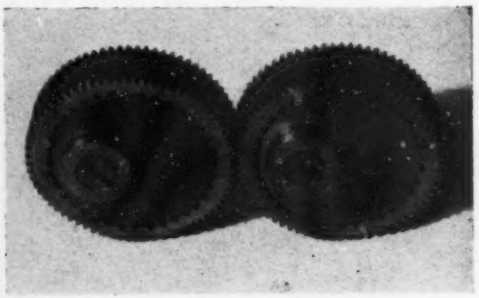


Gamet 2-row Taper Roller Bearing Cut Away to Show the Form of the Cage

Elliptical Gears for Aircraft Controls

A special machine was developed by the Automobile Gear Division of David Brown Industries, Ltd., Lockwood, Huddersfield, for cutting the pair of elliptical gears shown in the figure; which, it is stated, presented one of the most difficult production problems ever encountered. The gears are part of the flying controls of the Bristol Britannia air liner, and eight sets are employed in each aircraft. Each gear is slightly less than 2½ in. diameter and there is a difference between the major and minor axes of 0·14 in. The face width is ½ in., and there are 71 teeth of 30 d.p.

The inner serrations provide for matching the central portions, which are bored ½ in. off-centre.



Elliptical Gears for the Flying Controls of the Bristol Britannia Air Liner

Die Casting Supplement

Ferranti Die Castings for Electricity Meters

Ferranti, Ltd., whose extensive activities include the large-scale manufacture of electricity meters, have recently established a light-alloy die casting foundry in this section of their Hollinwood works, and a variety of castings for such meters is now being produced in quantity. Two die casting machines are at present installed, comprising a Reed-Prentice No. 2G and a Reed-Prentice No. 1½G, built by Alfred Herbert, Ltd. Metal is supplied by two Birlec-Tama induction-type bale out furnaces fitted with tilting mechanism. Each furnace is of 40-kW. rating, with a holding capacity of 450 lb., and a melting rate of 200 lb.

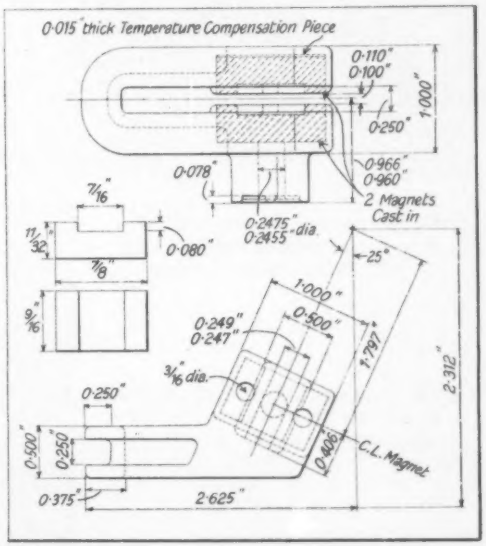


Fig. 2. Die Cast Brake Magnet Assembly for a Ferranti Polyphase Meter

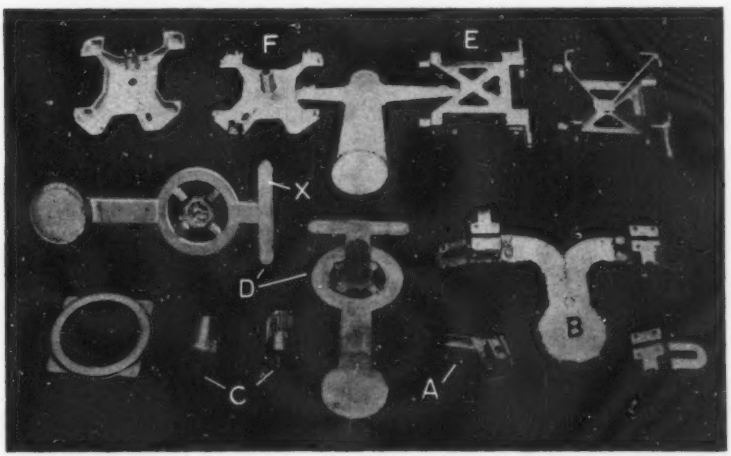


Fig. 1. Some of the Castings for Electricity Meters Produced by Ferranti Ltd.

per hour. A horizontal tumbling barrel, supplied by R. Cruickshank, Ltd., Birmingham, is provided for de-flashing the smaller castings.

Some of the castings now being produced are shown in Fig. 1, and the component seen at *A*, and as cast (in pairs) at *B*, presents features of interest. It comprises the braking magnet assembly for a polyphase meter, and incorporates

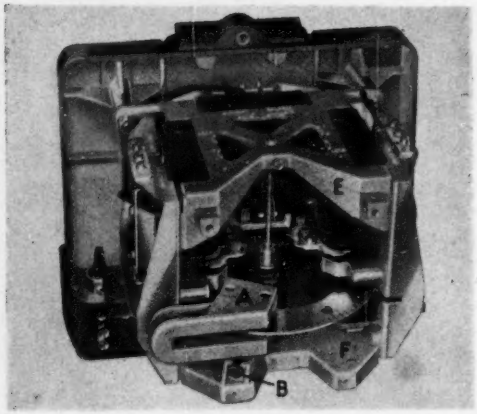


Fig. 3 (above). The Ferranti Polyphase Meter which Incorporates a Die Cast Brake Magnet Assembly

two Alcomax permanent magnets which are cast-in, as shown on the drawing Fig. 2. Behind one magnet there is also cast-in an 0·015 in. thick temperature compensating plate. The magnets straddle the meter disc as may be seen in Fig. 3, and the die cast assembly, indicated at *A*, is adjusted in relation to the disc centre by means of the screw *B*.

The magnet assembly *A* is cast in 3L33 aluminium alloy, a material which has a high resistance to corrosion, and the moving and fixed members of the two-impression die that is employed for producing it on the Reed-Prentice 2G machine are shown in Fig. 4 and 5. The drawing, Fig. 6, gives some details of the construction, and it will be seen that by providing two impressions, a tool of symmetrical design has been obtained.

A sliding, angular core, seen withdrawn at *A*

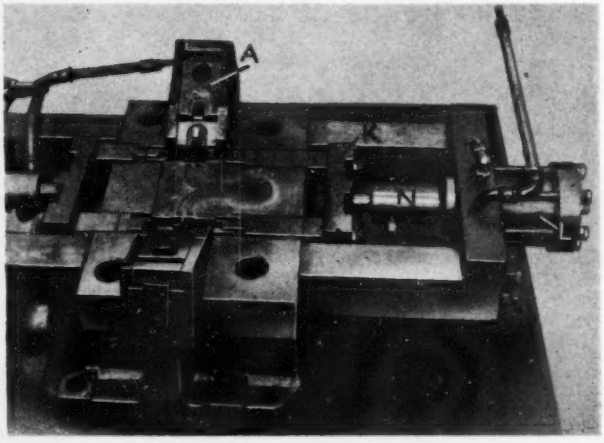


Fig. 4 (right). View of the Moving Die Member which Incorporates Hydraulically and Mechanically-operated Cores

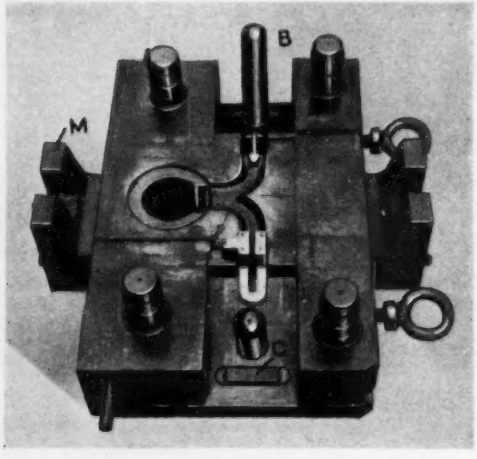


Fig. 5 (below). The Fixed Member of the Die for Producing the Brake Magnet Assembly

in Fig. 4, produces the web portion of the casting. These cores are actuated in a conventional manner, as the die opens and closes, by means of angular pins *B*, Fig. 5, in the fixed die, and one of them is seen in the working position at *A* in Fig. 7. Referring to Fig. 5 and 6, the core is locked by a tenon block *C*, and it is retained in the withdrawn position by a spring-loaded plunger *D*, which engages a dimple at *E*.

A pair of magnets, and the temperature compensating plate to be cast-in, are seen in position at *F* in Fig. 7. Each magnet rests on two ⅛-in. diameter pins for height location, and the two magnets are held against a die insert *G*, which determines the 0·100-in. gap between them. Clamping is effected by the sliding cores *H* and *J*, each provided with two ⅜-in. diameter projections at the front, which bear on the rear faces of the magnets. It will be seen that the core *J* also

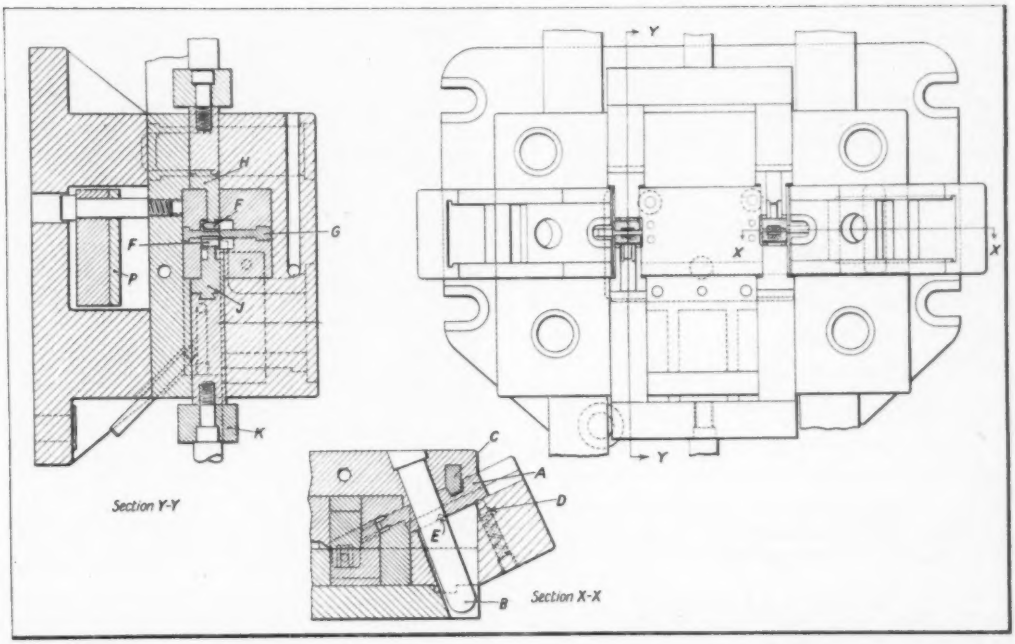


Fig. 6. Details of the Die for Producing Brake Magnet Assemblies

forms the rectangular side boss with a 0·249/0·247-in. wide tenon groove, and a centre hole of 0·2475/0·2455 in. diameter. Both cores are dovetailed into their mounting bars, to provide for easy replacement if necessary. The right- and left-hand pairs of core mounting bars are connected, with a certain degree of float, for alignment purposes, to cross-heads as at *K* in Fig. 4, which, in turn, are coupled at their centres to the piston rods of hydraulic cylinders *L*. In Fig. 4, the cores are seen withdrawn. Angular faces on the cross-heads *K*, which engage wedges *M* on the fixed die Fig. 5, provide for positive locking of the cores when the tool is closed. Since each magnet is clamped at two points immediately behind the bearing steps on the front face, any possibility of cracking of the material under the applied pressure is avoided.

To prevent damage to the gland packings of the hydraulic cylinders due to the heat of the tool, water cooling is provided for the cylinder neck, also, through sleeves *N*, for the piston rods. Ejection of the castings is effected by means of five knock-out pins in the plate *P*, Fig. 6. The pins bear on the sprue only—two adjacent to each

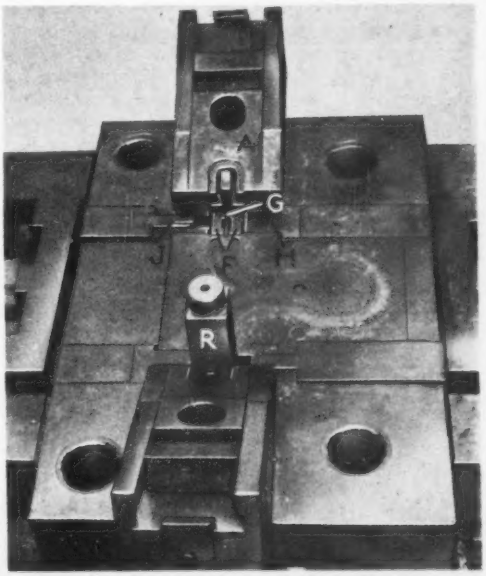


Fig. 7. View of the Moving Die for the Brake Magnet Assembly Showing a Pair of Magnets *F*, which have been Loaded with the Aid of the Special Holder *R*

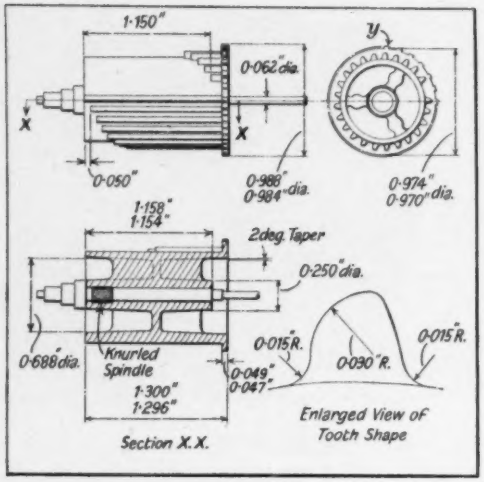


Fig. 8. Gear Drum Component for a Prepayment Meter, which Incorporates a Cast-in Spindle. No Taper is Permissible on the Periphery

casting and one in the centre, as may be seen in Fig. 4.

Loading of the two magnets and the temperature compensating plate into each die impression is facilitated by first placing them in a holder *R*, Fig. 7, wherein they are retained by spring steel side and end plates. The holder incorporates a spring-loaded centre blade which corresponds to the location insert in the tool, and moves backwards as the magnets are loaded. The hydraulically-operated cores are then closed to clamp the pairs of magnets, and the two holders are removed. An output of 80 castings per hour (40 shots) is obtained from this die.

ALUMINIUM-ALLOY GEAR DRUM COMPONENT

The component *C*, Fig. 1, which is also shown in the drawing, Fig. 8, is of LM2 aluminium alloy, and incorporates a cast-in steel spindle. It is part of the fixed charge collector mechanism for a Ferranti pre-payment meter, and no taper is permissible on the periphery. The teeth are of a special form, and must be accurate for profile and concentricity with the spindle.

Since the particular components shown are prototypes, only a small quantity was required. They were produced, therefore, in a single-impression tool, and components as cast are seen at *D* in Fig. 1. Satisfactory feeding was obtained by providing four gates from a circular sprue, and an overflow *X* ensure sound metal in the casting.

The fixed member of this single-impression tool is seen at *A*, Fig. 9, and the moving member at *B*. The cast-in centre spindle is knurled at the neck for keying purposes, and it is located in the fixed die, as seen at *C*, by the 0·062-in. diameter shank, which is made sufficiently long for this purpose and is afterwards shortened. A spring-loaded plunger bearing on the end of the shank holds the spindle up to a stop face in the core insert *D* of the moving die, seen dismantled, and the teeth are formed in the internally-broached die insert *E*. Ejection is effected by four pins, one of which bears on each gate. Raised portions *y*, Fig. 8, on the casting flange are subsequently marked in red, and the spaces between them in white. The problem of producing the component without external draft was solved by allowing it to cool in the die for a sufficient period while the metal shrinks away from the bore of the broached insert. To facilitate the subsequent ejection, a generous draft is provided on the cores.

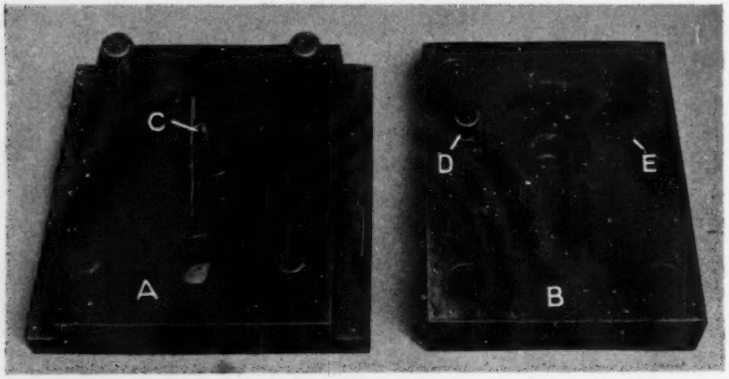


Fig. 9. Single-impression Tool for Producing the Die Cast Gear Drum Component Seen in Fig. 8

A multiple-impression tool, it may be noted, is to be made for the economical production of this gear drum component in quantity.

The top and bottom aluminium alloy frames,

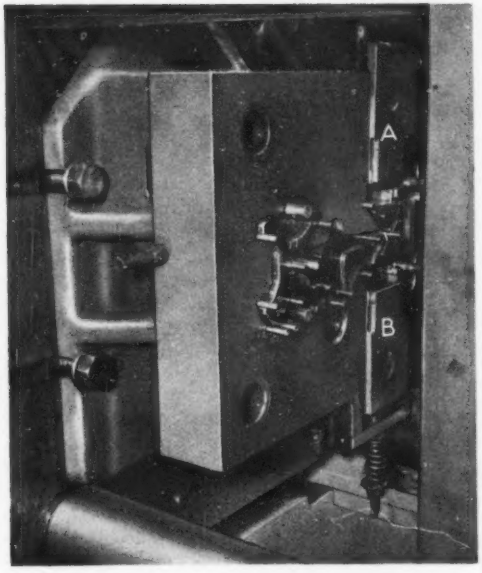


Fig. 10. View of the Moving Die Set-up on the Reed-Prentice 1½G Machine for Making the Die Cast Frames of the Meter Seen in Fig. 3

pairs, as shown in Fig. 1, on the Reed-Prentice No. 1½G machine, and a close-up view of the moving die, with the ejectors advanced, is given in Fig. 10. The sliding cores *A* and *B*, which produce the side pockets in the casting *E*, are actuated by the die movement through the medium of angular pins on the fixed die. No sliding cores are necessary in the die impression for the part *F*. An output of 60 shots per hour is obtained from this tool.

Meter case backs, terminal covers and front covers, with relatively thin walls and in a variety of types, are among other die cast components which the company are now producing. One type of case back is shown in Fig. 11. It is produced in a two-impression die on the No. 2G machine and it will be noted that overflows are provided at *A* and *B* to ensure sound metal. Removal of the castings from the die in this instance is effected by a stripper plate, and not by pins, and the cores are provided with large-diameter steady dowels in their outer faces which engage hardened steel bushes in the opposite die member.

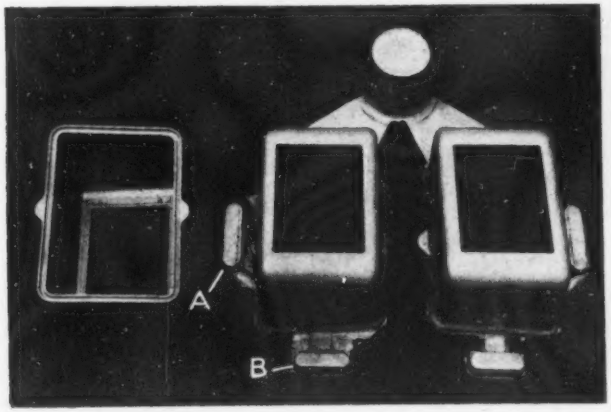


Fig. 11. Case Backs for a Ferranti Electricity Meter Die Cast in Pairs

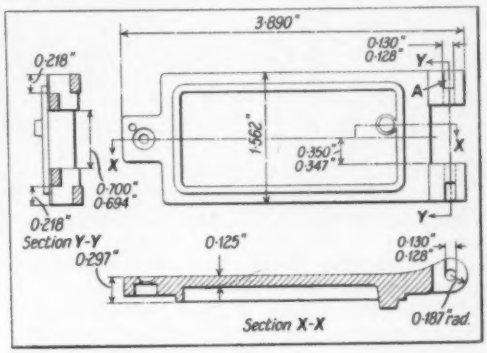


Fig. 12. Plastics Moulded Cover so Designed that the Hinge Pin Holes can be Produced without the Need for Sliding Cores

Attention may also be drawn to a plastics cover component shown in Fig. 12, which is being produced on a Herbert-Edgwick type HY injection moulding machine in the same department. This cover is of interest in that the design provides for a hinge pivot hole that can be produced without the need for sliding cores in the mould, so that tool costs are appreciably reduced. The method whereby this result is obtained will be evident from the drawing. The two hinge bosses are merely provided with opposite-facing U-slots as at A, which afford adequate support for the hinge pin, and can be produced by fixed inserts in the mould.

Pressure Die Casting of Zinc in the Necchi Foundry

Articles which were published in MACHINERY, 92/499—28/2/58, and 92/973—25/4/58, were concerned with the newly-established pressure die casting foundry of Necchi, S.p.A., at their factory in Pavia, Northern Italy, where they have been established for more than 100 years. This new foundry is equipped for the production of castings in aluminium and zinc alloys, and has a total output of 40 tons of aluminium and 15 tons of zinc castings per month. More than 80 different castings are made, all of them for sewing machines, which are currently being produced at the rate of more than 1,000 per day, and the foundry supplies all the needs of the factory. Details of the foundry layout, the plant and equipment, and some of the more interesting of the aluminium castings at present in production, were given in the two articles mentioned above, and the production of castings in zinc alloys is here discussed.

Pressure die casting of zinc is carried out in an area of the foundry which is separated from that devoted to aluminium. In this area are installed one Triulzi (Alexander Cardew, Ltd., 2-5 Studio Place, Kinnerton Street, London, S.W.1), Z30 and two Z25 water-hydraulic machines, of 90 and 60 tons capacity, also one Idra oil-hydraulic machine of 80 tons capacity. A general view of the Z30 machine is given in Fig. 1, and the two smaller machines are of similar design. All three Triulzi machines are supplied with water, mixed with 5 per cent of soluble oil, under pressure from a central pumping station, which also serves the machines engaged on aluminium alloys. As may be observed, the machine has two tie bars, one above and one below the centre of the platens, which measure 17¾ by 16½ in. The moving platen is attached to the ram of a horizontal hydraulic cylinder, which is cast integral with the fixed platen at the left, and all the main machine members are steel castings.

The main die locking force is applied by this central cylinder, which operates in one direction only, power for opening the dies being supplied by two smaller cylinders, above and below, and a total force of 6½ metric tons is available for this purpose. Ejector pins are advanced, as the die reaches the fully-open position, by two adjustable stops against which the ejector plate is pressed. Alternatively, rack and pinion-operated ejectors may be fitted. The hot chamber and holding furnace at the right-hand end of the machine is insulated by means of shrouds fabricated from sheet steel and glass fibre, to prevent the escape of heat and improve the operator's working conditions. A total injection force of 5 metric tons can be exerted by

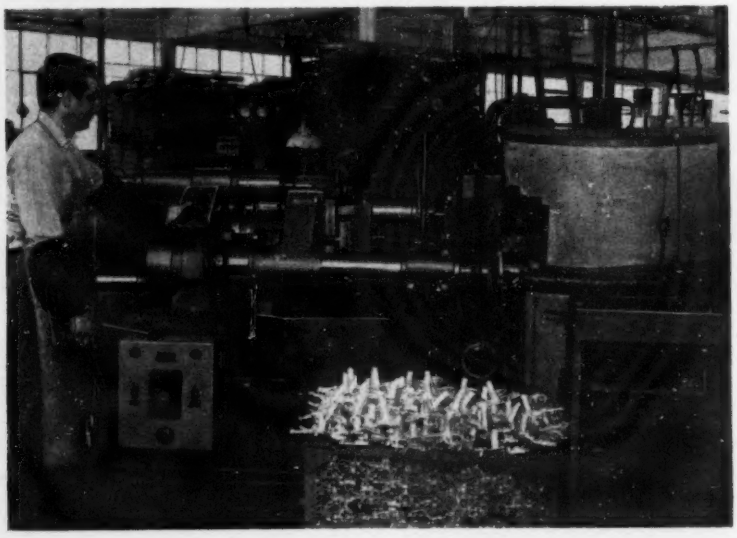


Fig. 1. This Triulzi Z30 Hot-chamber Machine, which has a Capacity of 90 tons, is Installed in the New Necchi Foundry for the Production of Zinc Die Castings

the vertical cylinder, which has a stroke length of 6½ in., and the machine has a shot capacity, in zinc, of about 2½ lb.

A close-up view of the die on this machine is given in Fig. 2, where a spray of castings is seen at the right. This die has four cavities for different components of the Mirella domestic machine, and a fifth which is not in use. The cavity at the top of the die produces a 2½-in. diameter spur gear, with 63 teeth, which forms part of the drive from the hand crank to the bobbin winder of the sewing machine. At the left of the die centre there is a cavity for a pulley, with axial ribs on its periphery, whereby the sewing machine crankshaft is driven by a special belt. A steel bush insert is required in the centre of this pulley, and is grooved and knurled on the periphery to ensure that it is securely gripped. The two other castings are a link arm, with two ⅜-in. diameter holes at 1½-in. centres, and a bobbin case holder. These castings are produced at the rate of 100 shots per hour, the machine being fitted with equipment, housed in the box at the lower left-hand side in Fig. 1, whereby the dies are automatically opened at the end of a pre-set period, and the castings ejected.

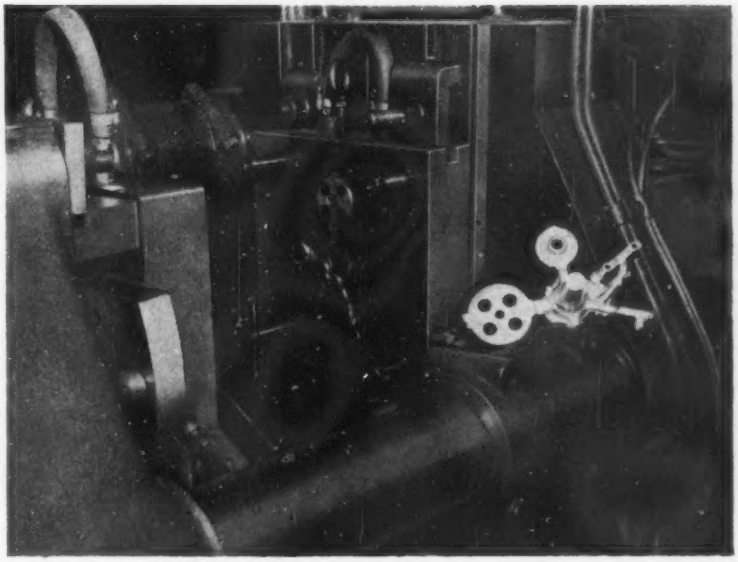


Fig. 2. Close-up View of the Die Employed on the Triulzi Z30 Machine, Showing the Arrangement of the Cavities which Produce Four Different Sewing Machine Castings

Some further examples of zinc castings from the range produced in the foundry are seen in Fig. 3, where those from the die in Fig. 2 are also shown. The gear is indicated at *A*, the pulley at *B*, the link at *C*, and the bobbin case holder at *D*. Among the other castings, those at *E* are covers for gearing on power-driven machines, and those at *F*, to which later reference will be made, are electric motor end covers. At *G* is seen a cover for a balance wheel and driving belt, combined with a bobbin winder support, and at *H* a needle bar support casting. This casting incorporates brass bushes in the two off-set holes, and is employed on the Necchi Supernova zig-zag stitch machine. The needle bar is held in a vertical position in the two bushed holes, and the casting is supported on the presser bar by the other holes. When zig-zag stitches are to be produced, the casting is turned on the presser bar, to carry the needle bar to the required positions, while maintaining it vertical, and this is an important feature of the Necchi design.

At *J* is a bobbin winder support casting of interesting design, with four cored holes, in two planes, two of the holes in one plane being at 90 deg. to each other. These two holes are produced by moving cores operated by cam pins. The casting at *K* forms part of the feed dog lifting mechanism, and also serves to disengage the feed when the material is to be moved through the sewing machine by hand. This casting incorporates a steel stud and a steel bush insert, at opposite ends, both of which are cast in position. The bushing at *L* is mounted on the upper shaft of the assembled sewing machine, and carries the balance wheel. It can be locked to the shaft for sewing, or freed for bobbin-winding, and it has a large brass bush insert at the centre. This bush has outside and inside diameters of ⅝ in. and ½ in., and is 1½ in. long.

At *M* is the balance wheel mentioned, and at *N* is a locking ring and bush for the shuttle body. The casting at *P* is an upper pulling drum for the automatic pattern stitch mechanism on the Super-

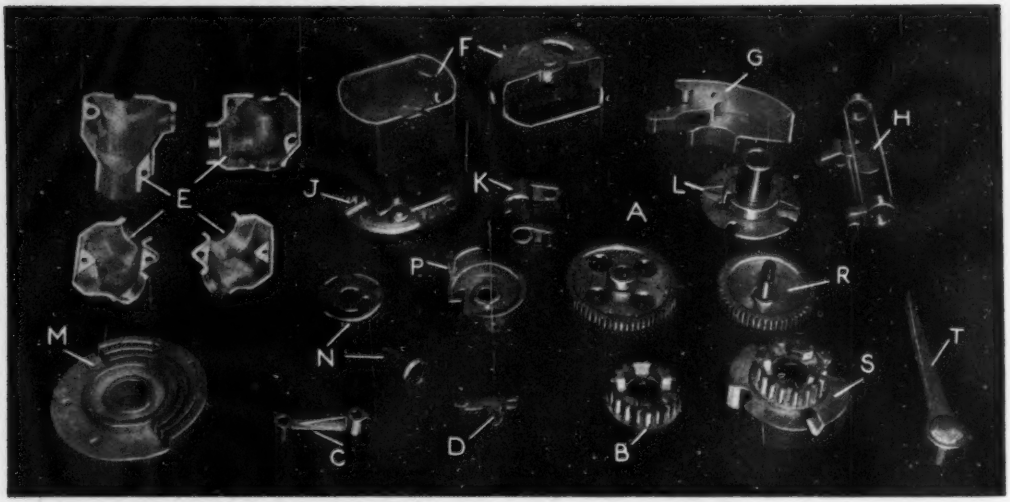


Fig. 3. Examples of Zinc Pressure Die Castings for Necchi Sewing Machines. The New Foundry has an Output of 15 tons of Zinc Castings per Month, all for Sewing Machines

nova zig-zag machine, and that at *R*, the driving gear for a power-driven machine. This gear has a central steel stud of approximately $\frac{5}{8}$ in. diameter, which is finish-ground to size over part of its length, and threaded at the end before being cast in position. The counter-weight *S*, for the Mirella machine, has a heavy steel bush insert, and is cast with axial grooves similar to those or the pulley *B*, which it drives in the assembled unit, through the special belt. At *T* is a cam-operated lever for the button-hole mechanism on certain machines.

IDRA HOT-CHAMBER MACHINE

A general view showing the Idra 80-ton capacity, hot-chamber machine, mentioned earlier, is given in Fig. 4. It is of the self-contained oil-hydraulic type with a toggle-operated moving platen. Made by Costruzioni Idromeccaniche Bresciane, of Brescia, the machine is of conventional four tie-

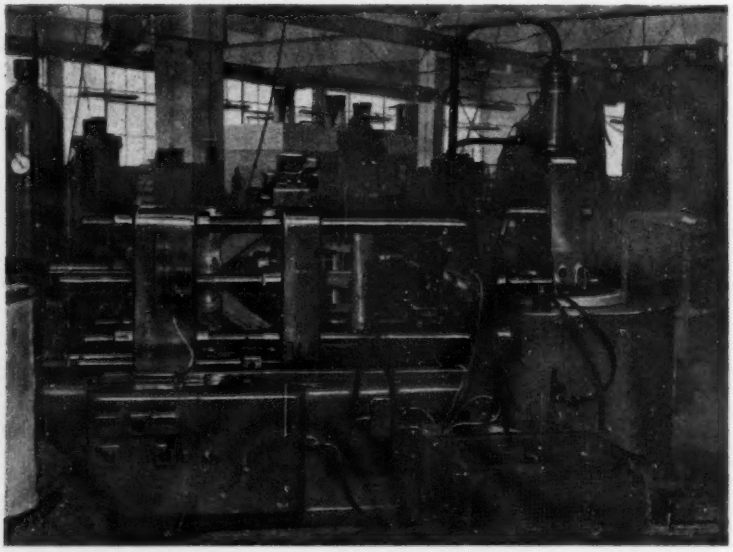


Fig. 4. A General View of the Idra 80-ton Capacity, Hot-chamber Machine which has been Recently Installed. Of Conventional Four Tie-bar Construction, the Machine has a Hydraulically-powered Toggle Mechanism for Die Closing

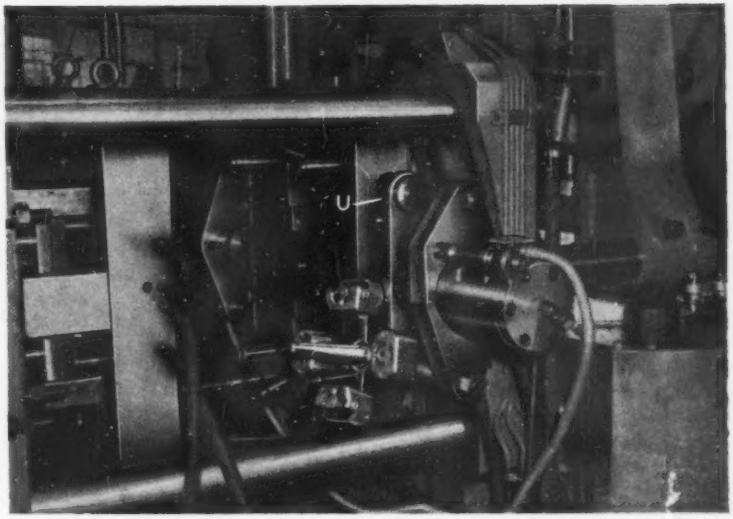


Fig. 5. Close-up View of the 4-cavity Die Employed on the Idra Machine for the Production of the Motor End Covers Seen at *F* in Fig. 3.

bar construction, and is designed for operation on a completely automatic cycle, which is electrically controlled. The controls provide for regulation of the platen speed, the force applied in closing the dies and injecting the metal, the speed of the injection plunger, and the dwell period for solidification before the dies are opened automatically. Hydraulically-operated ejection mechanism is fitted at the rear of the moving platen. Provision is also made, in the control arrangements, for advancing and retracting moving cores in the correct sequence, limit switches being fitted to ensure that one movement is completed before another is started. The holding furnace at the right-hand end is heated by electrical resistance and has a rating of 15 kW.

The die seen in position on the machine is employed for the production of two of each of the electric motor end covers *F*, Fig. 3, and has four cavities spaced at 90 deg. round the central sprue. A close-up view of the die is given in Fig. 5, where a spray of castings is seen at the right, and it will be observed that the cavities for the castings which are cut away at one end, as exemplified by the right-hand casting of the pair at *F* in Fig. 3, are disposed above and below the sprue. The cut-away portions of the upper and lower castings—in the die—are each produced by a vertically-moving core operated by a cam pin, the retaining springs for the upper core being seen in Fig. 5.

In addition, each of these cut-away castings requires a hole for the insertion of the brush-holder in each short, curved side, and these holes are cored by pins which are advanced and retracted by a horizontal hydraulic cylinder at each side of the die. The outer end of each core pin has a cheese-shaped head, which fits into a T-slot in the face of a plate *U*, attached to the cylinder ram. This plate is guided on the main support pillars for the hydraulic cylinder. One of the electrical limit switches, whereby the operation of the cores is interlocked with the machine cycle, is mounted on top of the cylinder, and is operated, as the core is moved, by a cam plunger connected to the cylinder ram. The arrangement is such that the injection plunger cannot be operated unless the cores are advanced, and the die cannot be opened until these cores have been retracted. The die has a projected area of approximately 28·5 sq. in., and the shot weight is about 2·2 lb.

VIBRATORY LAPPING. An article by Dr. Richard C. Hitchcock and Mr. John P. Moran, published in a recent issue of *The Tool Engineer*, describes a vibratory lapping machine which, it is claimed, enables surfaces to be finished to a high degree of smoothness and flatness. A lapping pan or table is attached to the armature of an electromagnet which is energized by pulsating direct-current, with the result that it is subjected to a frequency of 3,600 per min. The table is supported on a leaf-spring system, and the combination of vibratory motions obtained provides for a polishing action, also for travel of the parts around the table, the surface of which is covered with abrasive cloth. For light parts, pressure plates are employed, each of which may accommodate a number of components, such as shaft seals. When the table is loaded in this manner, the pressure plates travel round and, in addition, they are caused to rotate about their axes. At the same time, each part turns about its own axis, so that it partakes of a "3-way" motion.

Bath Radial Draw Former with Automatic Load Control System

The 25-ton radial draw former, here shown, has been supplied by the Cyril Bath Co., Solon, Ohio, U.S.A., to the U.S. Army Ballistic Missile Agency Huntsville, Alabama, for the production of components for the Jupiter guided missile.

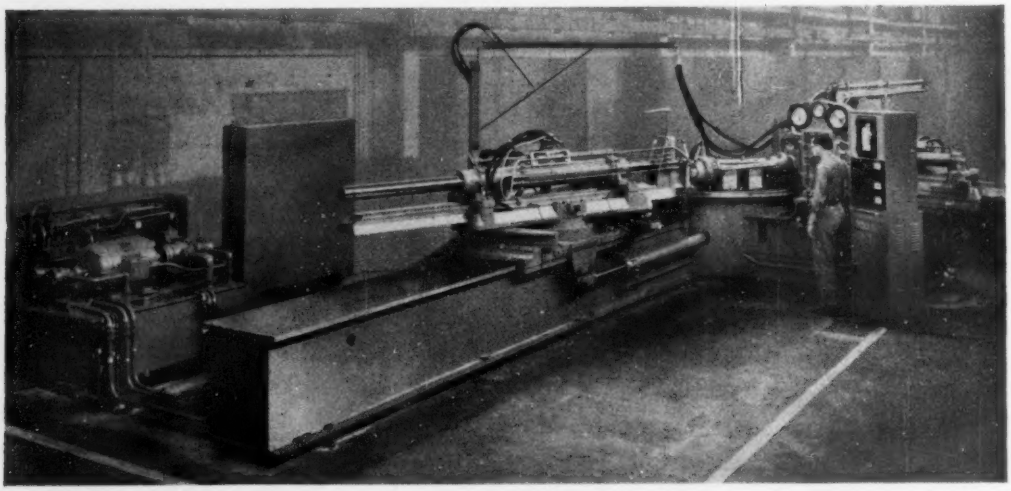
It is stated to be one of the first machines of its type to be equipped with an automatic system which determines, electronically, the yield point of the metal to be formed, and then continuously controls the tensile loads applied to the work during the forming operation. With this system, the risk of fracture of the work materia due to the application of excessive loads is virtually eliminated. Electronic equipment for the control system is built up from standard units and is housed in a separate floor-mounted cabinet. Dial-type instruments are provided for indicating elongation of the workpiece metal, yield point and tensile load applied during the forming operation. Provision is also made for continuously recording the tensile loads on paper strip.

The machine is intended for carrying out compression and stretch forming operations simultaneously, for the production of parts from such metals as titanium, magnesium, stainless-steel, aluminium and their alloys, in the form of sheet, strip and extruded sections. Control arrangements are provided for automatically stopping the work table in the same positions at the beginning and the end of each operating cycle. Limit switches can be fitted for operating relays to provide for varying, in steps, the tensile load applied to the work. Alternatively, continuous variation of the tensile load can be obtained by means of potentiometers, when parts are to be produced from tapered blanks.

A large-capacity radial draw forming machine incorporating the automatic load control system is being built by the company for the Convair Division, General Dynamics Corporation.

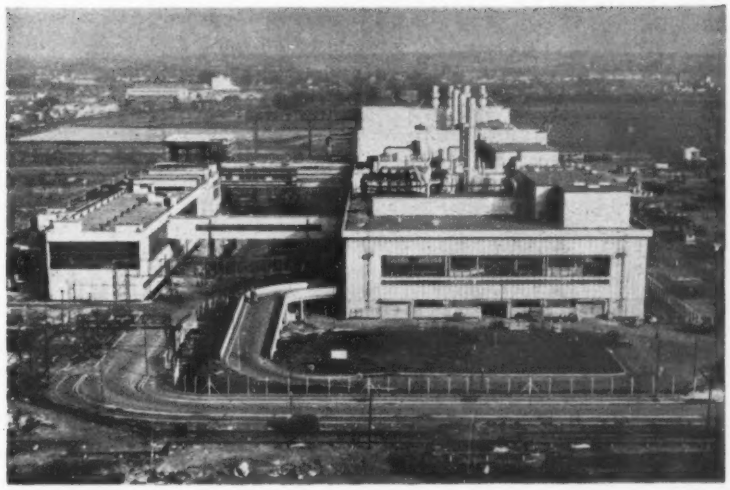
Bath radial draw forming machines are distributed in this country by Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11.

X-PRESS TAPS without flutes, for producing internal threads in non-ferrous metals and leaded steels by cold deformation, have been introduced by the Besley-Welles Corporation, U.S.A.



Bath Radial Draw Forming Machine Incorporating an Automatic Load Control System

The New Ford Thames Foundry



As reported in MACHINERY, 91/1350—6/12/57, a fully mechanized foundry for Ford Motor Co., Ltd., has recently been completed on a 22-acre site about half a mile from the main factory at Dagenham. Known as the Thames foundry, the new department, a general view of which is given in the heading illustration, has been erected and equipped at a cost of some £8 million, and is claimed to be the most advanced in Europe as regards layout, mechanical equipment, and working conditions, and to be directly comparable with similar units in the U.S.A. This foundry was part of the £65 million expansion scheme, started about three years ago, which is being financed entirely from the resources of the company, and the scheduled production figure of 400 tons of iron castings per day is now rapidly being approached.

This tonnage represents about two-thirds of the firm's total requirements, and consists, for the most part, of large castings, such as cylinder blocks, and tractor housings and wheels, with weights in excess of 30 lb. A labour force of only 1,800 men, all of whom will be transferred from the original foundry in the main works, will be employed. Because of the increased mechanization of the various processes in the new foundry, the output per man-hour will be approximately double that obtained in the original foundry, which will continue to operate with about half the former labour force. Full advantage has been taken of the

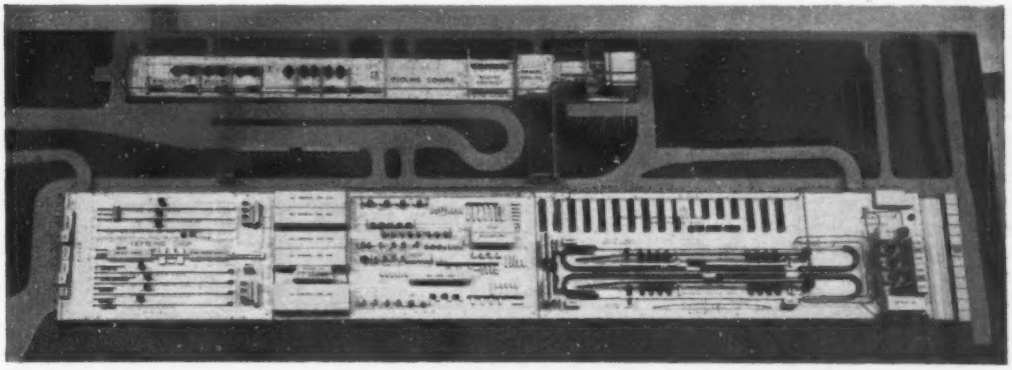


Fig. 1. In Planning the Layout of the New Ford Thames Foundry, this Scale Model was Constructed, Showing the Upper Floors of the Main and Auxiliary Buildings and the Arrangement of the Plant

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opportunity afforded to design a building specifically for operation as a foundry instead of having to adapt an existing layout, and a model showing the proposed arrangement of the production floors, which was prepared in the early stages, proved extremely useful. A view of this model is shown in Fig. 1.

BUILDING DESIGN AND LAYOUT

In order to improve working conditions in the foundry itself, as many as possible of the operations involving the handling of dirty materials, such as moulding sand, in which dust is generated, for example knocking out, have been concentrated in an auxiliary building at the left-hand side in the heading illustration. This building is connected to the foundry proper, at the right, by means of two tunnels, which provide for the movement of castings, and such materials as moulding sand, on special conveyors. Each of the buildings has two storeys, and the largest is 1,200 ft. long by 180 ft. wide, and 70 ft. high. The ground floor of this building contains offices, stores, air compression equipment, showers, toilets, and the maintenance department. There is also a locker room in which twin, heated lockers are provided for normal and working clothes, for each man.

In addition, there is a canteen with an area of 18,600 sq. ft., which can accommodate 700 men at a sitting, and is provided with the most up-to-date equipment. The ancillary building measures 700 by 60 ft. and is of the same height. On the ground floor there are stores, electric vehicle charging and maintenance rooms, sand control rooms, and a sprue mill for the removal of sand from core irons, which is served by a conveyor from the floor above. A layout drawing of the first floors of the two buildings is shown in Fig. 2, with the main building below. On this floor, there are columns, 60 ft. apart, which support lattice girders. These columns are also employed to carry much of the sand and casting conveyor systems, core-drying ovens, and material storage hoppers, so that the maximum of free space is available at floor level.

MELTING ARRANGEMENTS

The production floor of the main building is employed for melting, mould-making, closing and pouring, core-making, and fettling operations. In preparation for fettling, the castings are transferred, through the larger of the two tunnels in Fig. 2, into the auxiliary building. Here, they are allowed to cool, cores are knocked out, and certain flash-grinding operations are performed, to which reference will be made later. Melting of pig iron, steel, and returned scrap is carried out, at the extreme right-hand end of the main building, in four similar Cupodel 108-in. hot-blast cupolas, arranged in pairs across the width of the floor. These cupolas are supplied with air, at a temperature of 500 deg. C., from recuperators provided with ribbed alloy steel and cast iron tubes, past which the cupola gases are drawn. Before passing

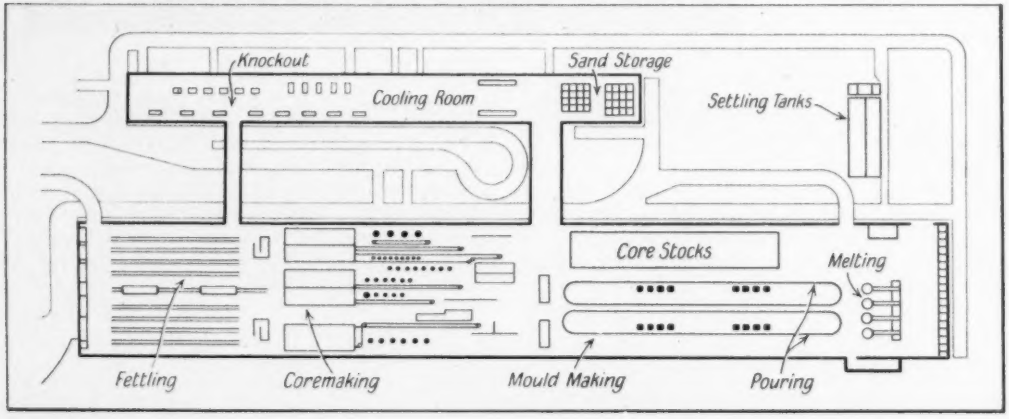


Fig. 2. Drawing Showing the Arrangement of the Ford Foundry. Moulds Made on the Twin Lines at the Right are Conveyed to a Pouring Station Adjacent to the Hot-blast Cupolas Employed for Melting

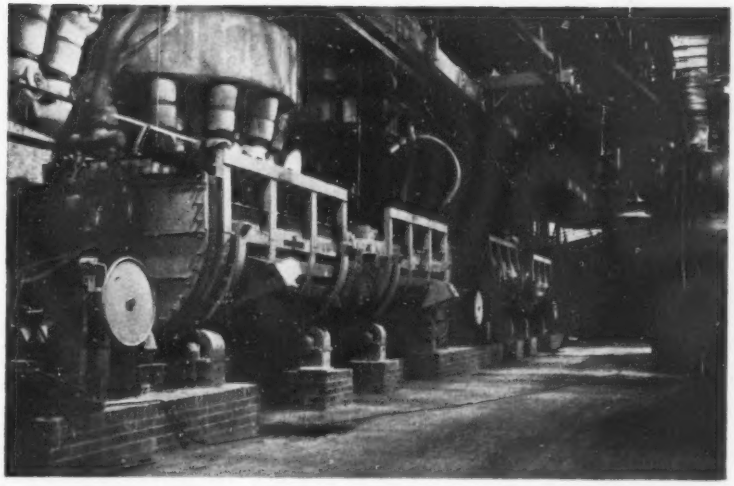


Fig. 3. From the Cupodel Hot-blast Cupolas the Metal is Tapped into Monometer Hot Metal Receivers, Each of 8-Tons Capacity, and then into the Ladles which Each Hold 2,000 lb.

over the ribbed tubes, the gases, which are extracted at a joint just below the top of the cupola, are drawn through a dust collector, and are further heated by burning in a combustion chamber, to which air is supplied.

An exhaust fan, driven by a 150-h.p. motor, draws the gases through the recuperator system, and they finally pass to a cone-type spark arrester on the foundry roof. The cupola blast is supplied by Keith Blackman high pressure centrifugal fans, driven by 275-h.p. motors, and passes through the recuperator tubes before entering the windbelt and the cupola tuyeres. In starting melting operations—which are thereafter normally continuous—at the beginning of each working week, the recuperator is initially heated by means of coke oven gas, which is burned in the combustion chamber. The outside surfaces of the recuperator tubes, which are arranged horizontally, are cleaned by the Swedish Broman-Ekstrom system, equipment for which is made under licence by Keith Blackman, Ltd. With this system, metallic shot is employed, which is distributed over the tubes, and dislodges dust as it passes downwards under gravity. The shot is recovered, separated from the dust, and lifted pneumatically, through a distance of 49 ft., to the top of the recuperator for re-use.

Pig iron and coke supplies are received at the extreme right-hand end of the main building in railway wagons. Iron is taken into the building and unloaded by means of two 6-ton capacity Babcock & Wilcox cranes, fitted with electromagnets. Coke is delivered in special containers which are lifted from the wagons by means of a hoist on a telpher system—just discernible in the

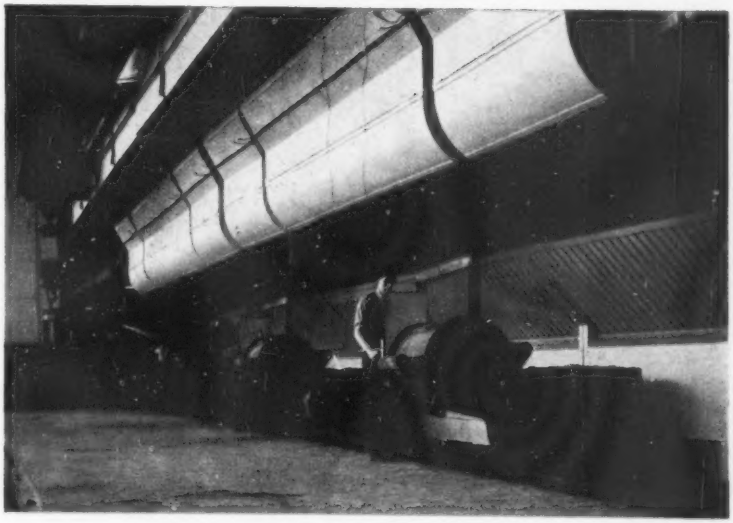


Fig. 4. Pouring is Carried Out with the Aid of Beck Ladles Supported on King Towing and Hoisting Units from a Monorail. Movements of the Ladle can by Synchronized with those of the Conveyor Track for Pouring

heading illustration—and discharged into storage hoppers adjacent to the cupolas. With this arrangement, breakage due to handling is reduced to the minimum. Limestone is handled by the same system. At the right-hand side—in Fig. 2—of the cupolas, are installed separate pre-weighing machines to which the various materials are delivered by chutes from the storage hoppers. Weighed loads of pig iron, coke, scrap, and limestone are discharged into skips which are hoisted, on inclined ways, to the loading doors and emptied into the cupolas at regular intervals.

At the other side of each cupola there is a Monometer hot-metal receiver, of 8 tons capacity, into which the iron is tapped almost continuously, as seen in Fig. 3. Normally, two cupolas are in use and two are in reserve, so that any maintenance work required can proceed without interrupting production. From the receivers, the metal is tapped into the ten 2,000-lb. capacity Beck ladles, employed for pouring, in succession. Each ladle is supported on a King electric towing and hoisting unit, the movements of which are controlled by the operator from a panel on the framework supporting the ladle. The ladles can thus be caused to move along on the monorail support at slow or fast speeds, and the manual effort normally associated with the transfer of hot metal from the tapping to the pouring stations is considerably reduced. At the pouring stations, one of which is seen in Fig. 4, the movement of a ladle on its monorail can be synchronized with that of a mould on the plate-type conveyor so that the operator need only watch the rate at which the metal is entering the mould. The melting arrangements include a pig-casting machine of 20-tons per hour capacity, for dealing with surplus metal.

MOULD-MAKING

At stated above, the new foundry is to be employed solely for the production of the larger castings, with individual weights of more than 30 lb., and the standardized cast steel moulding boxes employed, which were supplied by the English Steel Castings Corporation, Ltd., have dimensions of 45 by 30 by 16 in. Mould-making is performed on 16 Osborn automatic, single-station, machines, made under licence in this country by J. W. Jackman & Co., Ltd., and these machines are arranged, in lines of eight, within two continuous loops of Acme plate-type mould conveyors, as indicated in Fig. 2. In each line, four machines are employed for cope and four for drag half moulds. After leaving the pouring station in Fig. 4, at which the moulds travel away from the camera position towards the melting end of the shop, the boxes return along the inner runs of the conveyors. When the left-hand ends of the conveyor loops are reached, the metal in the moulds, although still very hot, has solidified, and on rounding the bend at that end, the boxes reach a position at which the castings are extracted, with the aid of an overhead hoist.

The casting is hooked on to one of two overhead monorail conveyors at this position, for transfer to the auxiliary building, and the moulding boxes, still partially filled with sand, continue on the conveyor. Just before the boxes reach the first group of four moulding machines, an air-operated ram pushes them on to a shake-out

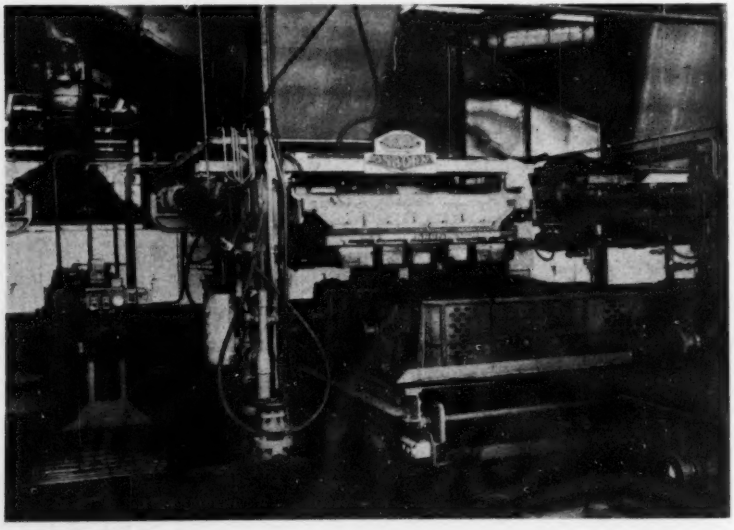


Fig. 5. One of the 16 Jackman-Osborn Single-station Type Automatic Mould-making Machines which are Arranged in Two Rows of Eight, Four being Employed for Drag and Four for Cope Half Moulds on Each Moulding Line

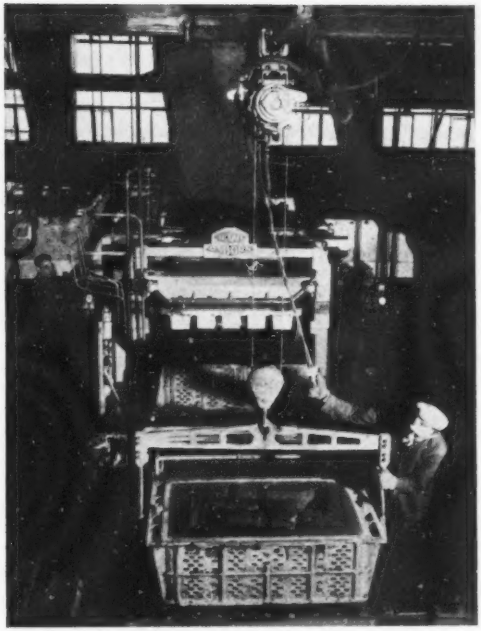


Fig. 6. Completed Moulds are Transferred from the Moulding Machine to the Plate-type Conveyor by Air-operated Travelling Hoists

machine installed in a floor pit. The top of this machine is at the same level as the conveyor, and after the sand has been removed the boxes pass on to another conveyor, which extends along the back of the row of moulding machines. It will be appreciated that these arrangements are common to both mould-making lines. A general view of one of the Jackman-Osborn machines is given in Fig. 5, which shows two of the moulding boxes mentioned, the box at the front, containing a completed mould half, being ready for transfer to the pouring conveyor.

From the return conveyor, the empty moulding boxes are pulled on to the feed rollers of the moulding machine by means of a latch on a travelling overhead carriage, which also contains the sand measuring box and carries the squeeze head. At the same time, the previously completed mould is pushed out of the machine to the position occupied by the box at the front in Fig. 5. After being fed into the machine, the empty box is lowered over the upward-facing pattern plate, which is secured to the table, and it is then filled with a pre-determined quantity of sand from the measuring box, by means of automatically-operated shutters. The machine table is then automatically jolted a predetermined number of times, to settle the sand firmly against the pattern surfaces, and the squeeze head is moved forward above the box. At the further side of the head, there is a doctor blade which strickles off excess sand, and at the end of the forward movement the sand measuring box stops beneath the storage hopper and is refilled, and the latch engages the next empty box on the return conveyor. The squeeze head is fitted with a plate which has rows of projections extending from its lower face, and these projections are now positioned directly above the spaces between the support bars of the moulding box.

The pattern is now raised, by a 36-in. diameter air cylinder in the base, to apply a squeezing force of the order of 70,000 lb. to consolidate the sand in the box. At the same time, the draw frames, which carry rollers, rise to such a height that these rollers are level with the other rollers of the machine and the table. Pattern and moulding box are then lowered until the box edges rest on

Fig. 7. In Placing Those Cores, which are Made Up from Several Interlocking Parts, in the Mould, this Air-operated Positioning and Clamping Fixture is Employed for Quick and Accurate Location

the draw frames, and a vibrator on the pattern plate is operated to free the pattern, so that it can be drawn downwards out of the mould. When the overhead carriage is now moved towards the front of the machine, the completed mould is pushed out and another empty box is drawn in from the conveyor at the rear. At the Ford foundry, the machines are operated on a semi-automatic cycle, which is interrupted just before squeezing takes place. This stage is then selected by pressure on two push-buttons, and it is thus ensured that the operator has both hands clear of the machine before squeezing takes place. Operations before and after squeezing are completed automatically.

Drag half moulds, which are produced on the first group of machines in each moulding line, must be inverted before being placed on the pouring conveyor. Above each machine there is a travelling hoist, as seen in Fig. 6, which is employed to lift the completed half mould on to the Acme conveyor. It may be noted that the conveyor plates are ribbed to allow free escape of gases during pouring. As the drag half moulds move along on the conveyor, they pass a core-placing station, where they are fitted with cores, which are delivered to the lines on special trolleys from the core stocking area at one side of the building. For some of the more intricate castings, the cores are built up from interlocking parts, and it is often more convenient to place such a core in position as an assembly. In such instances, special air-operated fixtures, of the type seen in Fig. 7, are employed. When the core parts are loaded into the fixture, they are positively located in the correct relationship to each other and to the mould. A lifting unit, incorporating air cylinder-operated hooks and clamps, is then lowered over the cores, where it is positioned by dowels similar to those employed for the location of the two half moulds. When all the air cylinders have been energized, the unit can be raised, the assembled core being thus lifted, and then lowered on to the drag half mould.

Here, the lifting unit is positioned by the mould box dowels, and air supply to the cylinders is reversed. The core assembly is thus released, and the unit is lifted clear. As the drag half mould subsequently passes the row of machines employed for making cope halves, the appropriate mould is lifted with the hoist and placed in position. Further along the conveyor, the moulding box is fitted with three U-section clamping wedges at each side. These wedges are hammered into engagement with cast lugs provided on the sides of the box halves adjacent to the mating faces, and the locating dowel pins are removed for return to the other end of the line. The moulds then reach the pouring station shown in Fig. 4, at which there are extremely efficient arrangements for the removal of smoke and fumes.

All the moulding sand employed in the foundry is treated in a battery of eight No. 80A Speedmullors, supplied by Herbert Morris, Ltd., and these machines are arranged in line, in two groups of four, between the mould and core-making areas of the foundry. Each of the rows, one of which is seen in the general view in Fig. 8, serves one of the two mould-making lines, and is capable of treating sand in quantities up to 200 tons per hour. Sand from the casting removal and shake-out points on the lines is returned to overhead storage hoppers in the roof space, and is discharged through pneumatically-operated gates into batch-weigh-

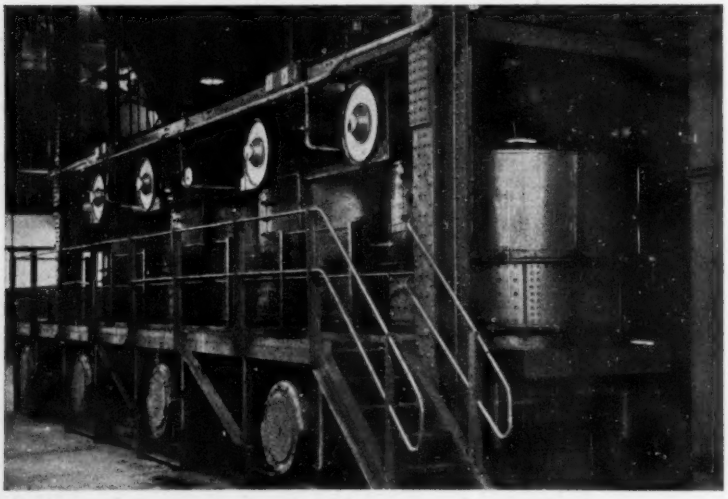


Fig. 8. One of the Two Batteries of Four Morris Speedmullors Employed for the Treatment of the Moulding Sand. Each Battery Can Handle 200 tons per Hour

ing hoppers above the machines. A scale beside each machine indicates the amount of sand in the weighing hopper and automatically closes the gates when the hopper is full.

When a machine becomes empty after a mulling operation, a quantity of flushing water is first admitted automatically, followed by the weighed batch of sand, and a measured quantity of slurry. Mulling of the sand is then carried out for a pre-set period, after which the discharge door of the machine is opened and the sand falls on to a conveyor belt to be carried to the hopper of the appropriate moulding machine. During the mulling process, the next batch of sand is being charged into the weighing hopper. The total time per batch of sand, including charging and discharging, is 70 sec. Fresh sand, from the storage part of the auxiliary building, is supplied to the machines as required, as will be explained later.

CORE-MAKING

The arrangement of the core-making portion of the foundry floor is indicated in Fig. 2, from which it may be seen that there are several lines of core-blowing machines with conveyors between the lines. Most of these conveyors are of the pendant-tray type, and they serve to carry the cores from the machines on which they are produced, through the curing ovens in the roof space at the left-hand end of the area, and back to the right-hand end for unloading. Here, those cores which require no further treatment are loaded manually on to shelves on specially designed stands, for transfer to the core stock area adjacent to the moulding lines. The stands are steel frames in which the shelves are hinged at one side, and when empty they are raised, by strong springs, to an angle of about 30 deg.

This feature enables the cores to be readily loaded, starting with the lowest shelf, since the other shelves are held in the raised position. The weight of one core will hold a shelf down in contact with its supporting stops. A total of 39 core blowing machines, of various capacities and designs to suit the types of cores to be produced, is installed in the area, together with core-stripping units, where the latter do not form part of the normal machine mechanisms. Among the suppliers of these machines may be noted Foundry Equipment, Ltd., J. W. Jackman & Co., Ltd., Fordath Engineering Co. Ltd., and Beardsley & Piper Co., U.S.A.

Units provided by the first-named company include the No. 220/530 automatic combined core-blowing and stripping unit shown in Fig. 9. This machine is one of five employed for the production of cores for tractor housings and has

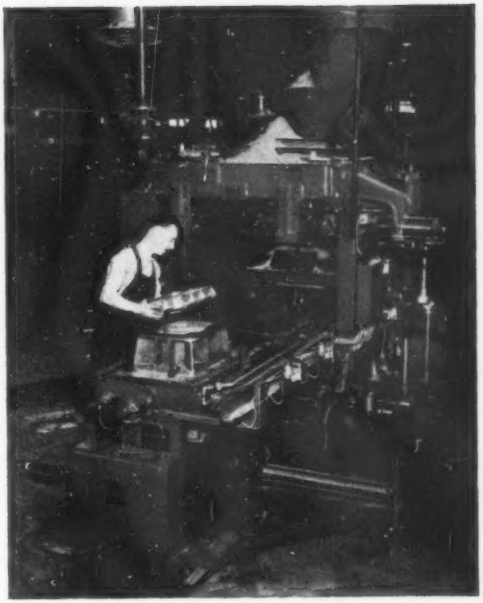


Fig. 9. Cores for Tractor Housings are Made on this Foundry Equipment No. 220/530 Core Blowing Machine which is Capable of Producing Cores Weighing up to 125 lb.

a capacity for core boxes with maximum outside dimensions of approximately 36 by 22 by 11 in. Cores weighing up to 125 lb. can be produced, and the machine incorporates five units which provide for blowing, inverting, transferring, pushing out, and lifting up the core to a convenient height for touching up by the operator and unloading. Each unit is interlocked with the others so that its function must be completed before the next can come into operation, adjustable time delays being employed where necessary. The blowing head of the machine, which is supplied with sand from a hopper, is fitted with a top half box for the core to be made, and two lower half boxes for the same core are fitted to two plates.

The plates are arranged back to back in the machine, and each can be moved by a long-stroke air cylinder, when it occupies the upper position, into place beneath the blowing head. It is then raised by a hydraulic cylinder into engagement with the box half on the blowing head, and the sand in the head is automatically blown into the cavity. After a pre-set period, the air pressure is cut off from the head, and the internal pressure released, before the lower half box is moved down

on to the wheeled track for transfer out of the machine, to the position shown. At the same time, the blowing head, which is mounted on a horizontally-moving carriage, is traversed by an air cylinder to a position beneath the hopper outlet, to receive another charge of sand. A support plate is then placed on top of the open end of the core box, as shown, and two arms are swivelled inwards to clamp the plate to the box.

During this sequence, the core, which was blown at the previous cycle of operations and moved back into the roll-over frame for inversion, is stripped and unloaded. A close-up view, from the other side of the machine, is given in Fig. 10, and at the beginning of the cycle a draw-saddle, fitted with two transverse spring-loaded bars, is raised to a height at which the bars are pressed against the underside of the support plate. The clamping arms are then drawn back and vibrators are started to free the core from the box. A slow downward movement is then imparted to the draw-saddle, followed by a somewhat faster movement as soon as the core has been freed from the box. When the draw has been completed, a cylinder at the further side of the stripping unit pushes the core, with its support plate, on to the bars of the lifting mechanism, whereby it is raised to the position shown. The operator can then insert any loose pieces, or do any necessary touching up, before unloading the core and placing it on one of the conveyor trays. The machine will normally produce cores of the type shown at the rate of about 4 per min.

The largest core-blowing machines installed in the foundry were also supplied by Foundry Equipment, Ltd., and Fig. 11 shows one of these units in the manufacturer's works, prior to delivery. Known as the C.B. 300 semi-automatic, twin-station, vertical core-blower, this machine comprises a central blowing station with a core-stripping station on each side. Since the cycle of operations performed by each stripping station is identical, it will only be necessary to describe one of these units, which operate alternately when the machine is employed on the semi-automatic cycle, one core box being blown while the other is being stripped. A feature of the machine is that it permits the use of core boxes, for the production of intricate cores, which require to be opened in four directions. Such a core box is fitted inside a chamber which is trunnion-mounted, for inversion, on a travelling carriage, and the various parts are secured to the rams of air cylinders, whereby they are moved together to form a complete box for the blowing operation, and withdrawn for ease in stripping.

The manual portion of the cycle starts with the box parts in the retracted positions and the chamber can be tilted to an angle of about 45 deg., if required, to enable a stripping solution to be sprayed into the interior. With the box in this position, it is also possible to insert any vent tubes or other core parts required, in readiness for blowing. The box parts are then advanced into engagement with each other and the chamber is brought back to the horizontal position for the first part of the automatic stage of the cycle, which is initiated by push-button. At the beginning of this stage, the core box, on its carriage, is moved to the central blowing station. The blowing head, again, is arranged to shuttle between the blowing and re-fill positions, and is fitted with a cover which

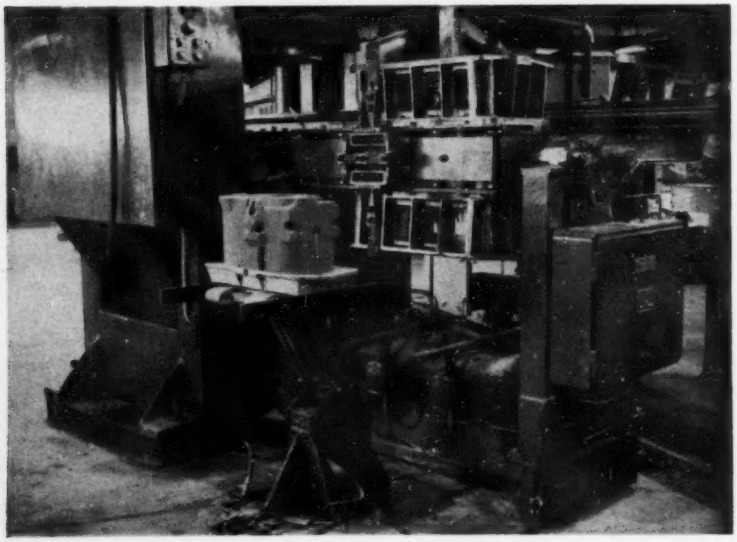


Fig. 10. In this View from the Further Side of the Machine in Fig. 9, Details of the Core Transfer, Stripping, and Lifting Mechanisms May be Seen. Cores are Produced at Rates of up to 4 per min.

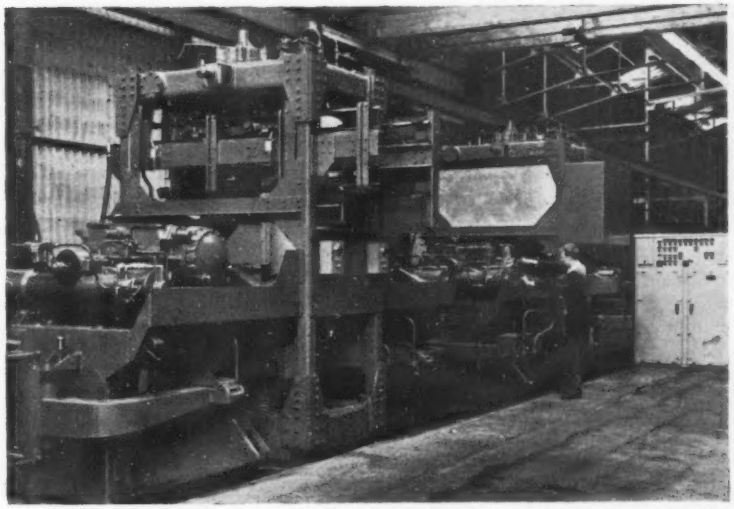


Fig. 11. Four of these Foundry Equipment C.B.300 Automatic Double-station Core-blowing Machines are to be Installed in the Foundry for the Production of Barrel Cores

closes the top of the core box when the latter is raised to engage it. As soon as the box is in position, the sand in the blowing head is injected, and after a pre-set period the air is released and the table lowered. A flat plate, holding a number of squeeze pins, is next swung forward over the core box, and the table is raised again so that pressure is applied to certain areas of the core to consolidate the sand.

To conclude the automatic sequence of operations, the table is lowered, and the core-box carriage is then moved out to the stripping station, where a support plate is placed in position over the open end of the box and secured with clamps. The box is then inverted, and the draw-saddle, which is of similar design to that employed on the machine in Fig. 9 and 10, is raised into contact with the plate. The vibrators are now started, and the core-box parts are withdrawn horizontally, so that the core is left standing on the support plate, which is afterwards lowered on the draw-saddle. For ease in extracting the core from the machine, a swinging arm is fitted to one of the support posts of the stripping unit, and is provided with two power-operated fingers, which can be raised beneath the core support plate, when the arm is in the advanced position, to lift the core from the draw-saddle. The arm is then swung clear of the machine for unloading. During these stripping operations on one core, the other core box is in the blowing position. There will be four of these machines, of which two have already been delivered; they will all be employed for the production of the intricate cores required for engine cylinder blocks and crankcases. Each machine has a potential output of 120 cores per hour.

Among the Jackman-Osborn core blowing units, there are nine No. 193A-2, four No. 193, and three No. 194A machines, all of which have automatic cycles. Pneumatically-operated, these machines are of conventional construction, and each has a table on which the closed core box is positioned by the operator, who then moves a handle to start the automatic cycle. During the cycle, the box is clamped, sand is introduced under air pressure, the air pressure is released, and the box is finally unclamped and ejected. Rollers are provided to facilitate the movement of the core-box into and out of the machine, and are arranged to sink below the table level during the blowing operation. The clamping piston of the machine has a maximum stroke of 10 in., and when horizontally-split core boxes are in use, one half can be secured to the blowing head. Only the lower half box need then be handled by the operator. With suitable core boxes, the machine cycle time may be as short as 7 sec. Equipment provided for the smaller cores includes eight Corall Junior, and four H5 Harsberg machines, also two Beardsley & Piper Flexiblomatic CB 400 units.

Many of the cores employed in the foundry require some form of coating before they are placed in the moulds and this work, also, is carried out in the core-making area of the foundry. Cores to be coated are fed to rows of benches, and after the dressing has been applied, by brushing or dipping, they are placed on another conveyor which leads to a drying oven. Some cores also require to be accurately sized, and this work is performed with the aid of special grinding machines, of both proprietary and Ford make, which have rotary and reciprocating tables, respectively. Such cores are ground on one side, to provide a flat face for location in the mould.

News of the Industry

Manchester and District

SIR JAMES FARMER NORTON & CO., LTD., Salford, are busy in all departments of their works. There is a brisk demand for automatic high-speed centreless bar turning machines of all sizes, and among special types we noted a 24-in. aluminium billet peeling machine. Bar reeling and straightening machines are another active line, and work in progress includes machines for bars up to 7 in. diameter. On order for the Atomic Energy Authority are nine 1½-in. automatic centreless bar turning machines, and ten, 2-roller, adjustable angle, bar straightening machines. We may also note that other machines are destined for atomic energy plants in Canada and Japan.

There is a good call for inverted, stationary spindle type, swaging machines, for rounds and sections, also for rotary spindle type machines. Our attention was drawn to a machine for 5-in. diameter tubes, with power feed mechanism. Drawbenches for wiredrawing, including inverted block machines, are in strong request, and some orders cover complete drawbench lines, each comprising a high-speed multiple bar drawbench, a shearing machine, a high-speed straightening machine, and fully automatic conveying gear. Good business is also reported by the rolling mill and textile machinery sections of the works, and in the latter connection reference may be made to a £500,000 order from Persia.

Since our last visit, additions to plant include a Tos 10 by 5 by 4 ft. plano-milling machine (Elgar Machine Tool Co., Ltd., 172/178 Victoria Road, Acton, London), two Herbert combination turret lathes, a Jones-Shipman slot Hydromil, and a Hey gear tooth rounding machine. Arrangements have recently been made with Sutton Engineering Co., Bellefonte, Pennsylvania, U.S.A., whereby their multi-roll straightening machines are now being built under licence at the Salford works. The agreement also provides for Farmer Norton automatic bar turning machines, swaging machines, and 2-roller, adjustable angle, reeling machines to be built under licence in the American works.

BARLOW & CHIDLAW, LTD., Pendleton, are well occupied on all types of gear-cutting, including spur, spiral, straight and spiral bevel, double-helical and worm gears, and racks, and medium and large size gears, represent a good proportion of the work in progress. Recent additions to plant include a Parkinson Sunderland No. 23 double-helical gear planing machine for 30 deg. angle, and a Webster & Bennett vertical boring and turning mill of 60-in. capacity.

H. FORDSMITH, LTD., Cornbrook, continue to work overtime to keep pace with the demand for gib head, plain taper, and parallel keys, with or without round ends, and hollow back keys of various sizes, also for solid and split taper pins, cotter and parallel pins, nuts and bolts, and screwed stud rods in various materials. There is also a good request for mild steel solid collars and split cast-iron collars, of both standard and special forms, and for spindles up to ½ in. diameter by 6 in. long in mild, silver, stainless, and other steels. A new development is the Brixham trawl winch which is being made at these works. Recent plant additions include four B.S.A. single-spindle automatic screw machines, an Essex centreless grinding machine, and a Ward No. 7 combination turret lathe.

ABRAMS ENGINEERING SYD ABRAMS, LTD., Waterloo Road, who, for some time, have built hand-operated strip rolling mills, have now introduced a power-operated mill for use in the sheet metal trades, and for dealing with electronics and precious metals, also lead strip. The heat-treated, alloy steel rolls are of 4 in. diameter by 6 in. wide, and vertical adjustment is provided to the top roll. Drive is taken from a 3-h.p. reversing motor, housed in a fabricated steel base, through a worm reduction gearbox. We hope to describe this machine more fully at a later date.

WALMSLEY'S (BURY), LTD., Bury, have received a £4,000,000 contract from Australian Paper Manufacturers, Ltd., Matraville, Australia, for a 250-ft. long machine to produce a sheet of paper 17 ft. 6 in. wide at a speed of 1,500 ft. per min. The approximate weight of the machine will be 1,200 tons.

THOMAS ROBINSON & SON, LTD., Rochdale, have drawn our attention to their timber incisor, which is specifically designed for piercing or incising the surfaces of timber sleepers and the like, in order to allow uniform diffusion and deep penetration of liquid preservatives and to minimize checking and splitting by reducing surface tension. The

incisions are ¾ in. long, spaced at 2¼-in. pitch, 1 in. apart, with ¼-in. stagger, and are made by a series of lances carried in four heavy incising rolls. The normal feed rate for sleepers and similar timbers is 60 ft. per min., but for larger timbers the rate is reduced to 30 ft. per min. Timber incised on this machine has absorbed as much as 40 per cent more preservatives than untreated material selected from the same delivery. We hope to make further reference to this machine in due course. H.B.

The South

C. J. NEUMAN, LTD., 445 Brighton Road, Croydon, Surrey, are well established as manufacturers of a wide range of grease nipples which are exported to all parts of the world. Their modern machine shop is equipped with multi- and single-spindle automatics, and numerous capstan lathes, for the production of nearly 500 types of nipples, which are supplied in both large and small quantities to many branches of industry. Motor-car, commercial vehicle, motor vehicle component, tractor, and agricultural machinery manufacturers are among the principal customers for grease nipples. The company also specializes in the manufacture of many types of grease guns and a popular item is a cartridge-loading gun which has been specially designed for use in conjunction with Nubrol grease cartridges. These cartridges contain high pressure grease suitable for general purpose lubrication. Another product of the company is the Nubrex grease pump, which is designed for fitting to a keg for extraction and delivery of lubricant. It is stated that pressures up to 7,500 lb. per sq. in., at the point of application, are readily obtained with this equipment.

PALCO ENGINEERING (LONDON), LTD., Horsham, Sussex, who are specialists in the design and manufacture of anti-vibration mountings, are now occupying premises at Brighton Road.

Extensions to the buildings, and the installation of additional plant, are planned, to enable the company to proceed with the manufacture of motor-car door locks, the mating parts of which have self-aligning characteristics.

HIGH SPEED SERVICE TOOL CO., LTD., 88 Maple Road, Surbiton, Surrey, to meet increasing demands for their wide range of tools, have provided additional production facilities which will enable delivery periods to be reduced. Two new Jones & Shipman universal grinders and three type 540 surface grinders, also a Moore-Catmur jig boring machine, have recently been installed under the plant replacement scheme.

The existing design and drawing office is to be supplemented by another, which is scheduled for early completion. A number of interesting press tools has recently been completed in these works. One of these tools, of complex design, produces a deep-drawn ferrule from 0·036-in. steel stock in 11 stages. Other tools of similar type are normally in progress. A special-purpose machine, developed by the company, is used for grinding the profiles of American-type piercing punches.

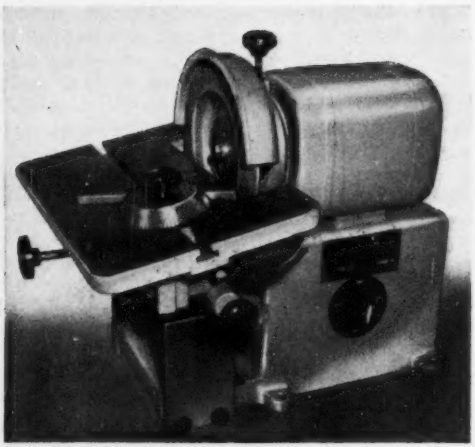
GEORGE VERNON, LTD., Stotfold Road, Arlesey, Beds., who are engaged in the production of fixtures and gauges incorporating dial indicators, or electric or air gauging units, report continued progress. This company has designed and made a number of special gauges for checking pitch and stagger of fir-tree root forms on gas turbine blades. Special gauging equipment is designed and produced to order. In addition there is a range of standard units for checking internal and external diameters, and effective thread diameters, also for determining eccentricity. Inspection equipment of this type is so designed that it can be used by semi-skilled labour. Semi-automatic and fully automatic inspection machines have also been designed and built for rapid 100 per cent inspection of components for the motor car and armaments industries.

Construction of a new works at Hitchin has been started and a further 4,000 sq. ft. of production space will thus be made available by the end of the year. Ingenjorsfirma A. Alfredeen, Siktgatan 1, Vallingby, have been appointed sole distributors of Vernon products in Sweden, Norway, Finland and Denmark. F. W. H.

Masterlap Tool Lapping Machines

Lester-Brown Machine Tools, Ltd., Bayton Road, Exhall, Coventry, Warwickshire, have introduced a range of single-ended and double-ended tool grinding and lapping machines, which may be bench mounted or supported on pedestals. Sold under the name Masterlap, they are designed for either low-speed or high-speed operation, depending on the type of abrasive wheel employed. The low-speed machine shown in the figure is designed for use with Macolaepp abrasive cup wheels, for which a surface speed of 1,500 ft. per min. is recommended. For a 6-in. diameter wheel, the correct spindle speed of 940 r.p.m. is provided by a specially-wound f.h.p. motor.

The abrasive grains incorporated in Macolaepp lapping wheels are said to have a hardness approaching that of diamond. These grains are



Single-ended Masterlap Tool Lapping Machine with a Tilting Table Carried on Leaf Spring Supports

held in a bonding agent which is pressed to shape and sintered, and the abrasive content is sufficient to ensure a long working life. Lapping is performed without coolant, and the operation is normally completed in about 5 sec. when tools have been previously ground on a Green-grit or diamond wheel.

The high speed machine, which is of generally similar appearance, is intended for grinding or lapping tools with suitable abrasive or diamond impregnated wheels. The motor speed on this machine is 2,860 r.p.m., and a coolant pump and tray are provided when wet grinding is to be carried out.

Features common to all machines in the range include a work table which is supported on leaf springs. With this arrangement, the work can be reciprocated across the face of the wheel by gentle pressure exerted by the operator's hand against the table. Stops are provided which serve to limit the movement of the table, and it may be locked, if required. A protractor, which can be adjusted and locked in a T-slot, enables the tool to be presented to the right- or left-hand edge of the wheel at the correct angle. A reversing switch is provided for changing the direction of rotation of the motor spindle.

The table is supported in a curved cradle, and the inclination can be varied from −5 deg. to +15 deg., by means of a small handwheel.

To facilitate changing the grinding wheel, the work table can be removed as a complete unit which is subsequently re-located in a tenon slot in the machine base.

The double-ended machine for wet grinding occupies a bench space of 15 in. by 30 in., and the single-ended machine a space of 15 in. by 20 in.

Fluid Power Conference

The first European Fluid Power Conference, organized by Compressed Air & Hydraulics, was held at St. Ermins Hotel, London, S.W.1, on May 14 and 15, and was attended by some 200 representatives from industry.

On the first day, five papers devoted to the uses of compressed air were presented for discussion. With the aid of coloured lantern slides, Mr. B. E. Wheadon (Desoutter Brothers, Ltd.), in a paper entitled "Pneumatic Tools for Mass Production," gave a comprehensive review of the many applications of air-operated tools for drilling, tapping, and assembling quantity-produced parts. There followed a paper on "Pneumatics for Automation," by Mr. W. G. Bennett (Climax Rock Drill & Engineering Works, Ltd.), who discussed the technological progress that has taken place over the last decade in the sphere of fluid-power control, and showed some examples of equipment fitted with air-operated units. Reference was made to a large press installation where parts for motor-car bodies are removed from the dies and placed on inter-press conveyors by air-operated lifting arms, also to a wire-coiling machine on which loading, unloading, and positioning of the reel carriers are effected automatically by air cylinders.

The second day of the conference was concerned with hydraulics, and the subjects of papers presented included "A Review of Modern Hydraulic Servo Techniques," by Mr. R. Hadekel (Sperry Gyroscope Co., Ltd.). The ultimate function of most hydraulic servo mechanisms, the author pointed out, was the movement of a mechanical member, usually against an appreciable load, and this could be accomplished by a rotary hydraulic motor, for example, and an associated control valve. With these items, a closed loop, or servo, system could be produced by the addition of a mechanical feed-back arrangement, which might be termed a "hydraulic force amplifier." Such units were applied, for example, to steering gears and to machine tools of the copying type. The term "hydraulic amplifier" might be used to describe any device which regulated the supply of power to a hydraulic motor. In practice, that most widely used was the slide type of servo valve. In an increasing number of servo systems, the

initial control signals were received as electrical impulses, and were converted to mechanical forces or displacements by an electro-mechanical transducer or torque motor coupled to the servo valve. Attention was drawn to the care required in the manufacture of servo valves, and some problems associated with these valves were discussed in detail.

"Hydraulic Operation and Control of Machine Tools" was the title of a paper read by Mr. P. Wilson, Stein Atkinson Vickers Hydraulics, Ltd., who made reference to the wide variety of machine tools developed by British designers, in which British-made hydraulic equipment was utilized.

Mr. D. Firth (Fluid Mechanics Division, Mechanical Engineering Research Laboratory) in a paper entitled "An Old and a New Look at Oil Hydraulics," discussed a simple system comprising a suction tank, valves, pump, and piping, from the aspects of existing theories, and of contemporary research. He recommended that more attention should be paid by designers to classical hydraulics and the results of research, and referred to the use of analogue techniques whereby hydraulic problems could be solved by reference to electrical theory. It was pointed out that although a very simple circuit has been considered in the paper, problems involved in its design were quite complex. Mr. Firth concluded by drawing attention to the facilities that were available to firms to enable them to develop designs and to improve their products.

The last paper of the conference, presented by Mr. I. McNeill (Ian McNeill, Ltd.), included a survey of the merits of direct-pump and accumulator systems, for operating heavy forging and deep drawing presses, for instance, and was also concerned with the conversion of existing press installations from mains to direct-pump supply.

Work Study Conference

Various aspects of work study were discussed at a one-day conference recently held by the North London Committee of the British Productivity Council, in the Council Chamber of the Federation of British Industries, 21 Tothill Street, London, S.W.1.

Papers presented for discussion during the morning session were as follows: "Method Study in the Office," by Mr. R. A. Randall (Work Study School, Cranfield) and "Fatigue Studies" by Dr. R. T. Wilkinson, Ph.D. (Medical Research Council, Applied Psychology Unit, Cambridge). Results of laboratory tests, said Dr. Wilkinson, showed that concentrated mental effort did produce physical fatigue. Satiation fatigue, a term which he preferred to use instead of mental tiredness, could be caused by the nature of some repetitive work and could be increased by the wrong sort of environment. This type of fatigue might be reduced by giving the worker a different kind of task to perform. Unfortunately, there was no easy way of measuring human fatigue and assessing fatigue allowances. In the latter connection, however, each job should be individually considered. Personality tests were of value in deciding on the type of work to which a person was most suited, and repetitive tasks, for instance, should preferably be performed by less intelligent persons.

The afternoon session opened with a paper by Mr. F. R. Curry (Imperial Chemical Industries, Ltd.) on "Work Measurement of Maintenance and Service Activities," and reference was made to a technique known as UMS (Universal Maintenance Standards), or "Estimating by Comparison." This system of comparing a new task with a number of known tasks was, he claimed, more economical to apply than were established techniques such as analytical sampling, and could be just as accurate. In an address on "The Use of Time-Lapse Photography in Work Study," Mr. A. G. Northcott (The Zinc Development Association), described how this system could be used to bring about a considerable increase in machine utilization time, particularly when a number of men worked as a team to perform a task. Finally, a paper on "Pre-determined Motion Time Systems," was read by Mr. S. Jennings (Philips Croydon Works, Ltd.), who explained the advantages of this method of estimating, which was based on analysing a simple task into elemental motions.

National Physical Laboratory

The recent open days at the National Physical Laboratory, Teddington, gave visitors the opportunity of acquainting themselves with some of the work which is being carried out by the various divisions.

In the Light Division, some very important investigations are proceeding in connection with the production of diffraction gratings by photographic means. Two coherent beams of light are caused to interfere at an angle within the depth of the layer of photographic emulsion. As a result striæ or layers of silver are formed, after development, each in a plane vertical to the supporting base. By suitable choice of emulsion and development procedure, having regard to the grain size and concentration of silver within the emulsion, a

uniformly spaced sequence of layers can be obtained, which constitutes an accurate diffraction grating suitable for metrology purposes where the moiré fringe technique is employed.

Applications of this technique, using circular diffraction gratings with radial lines, are extending. For example, an automatic recording refractometer was demonstrated in the Light Division. For this purpose, a prism, made from the material of which the refractive index is required, is mounted on a rotating table driven slowly by worm gearing. The position of the table is accurately read and recorded on a continuous chart by the aid of a circular grating and associated photo-electric and electronic equipment. In addition, the position is displayed digitally. At the same time, the intensity of light transmitted by the prism and received by the photo-electric head is recorded on the chart so that the angular position of the maximum can be determined.

An advantage of this system is that the continuous operation obviates jerkiness and inaccuracies due to sticking at the bearings, and inertia and torsion effects, so that a standardizing reproducibility becomes possible.

In the Standards Division a new design of photo-electric microscope was shown, of a type which can be used in the comparision of line standards. Only one beam of light is employed, which passes axially through the body of the instrument and through a slit which is vibrated by a simple electrostatic unit. Simplification has also been achieved in the associated electronic equipment.

Some work is proceeding on a proposed redefinition of the metre, using krypton as the source of monochromatic light. Doppler broadening of the lines is prevented by cooling the source with liquid air.

The Mathematics Division is continuing its work on electronic calculating methods, and some computing sequences were carried out with the "Digital Electronic Universal Computing Engine" (DEUCE), to demonstrate its speed and versatility.

Industrial Notes

CHAMBERLAIN PLANT, LTD., one of the Chamberlain Group of companies, recently moved to their new works and offices at Crown Works, Southbury Road, Enfield, Middlesex. This Company is interested in acquiring a good agency for contractors' plant, preferably in earth moving equipment.

ASSOCIATED TRANSISTORS, LTD., is the name of a company which has been formed jointly by the Automatic Telephone & Electric Co., Ltd., the English Electric Co., Ltd., and Ericsson Telephones, Ltd. A factory is being erected for this new company at Ruislip, Middlesex, and its primary purpose will be the manufacture of switching transistors to meet the requirements of the sponsoring companies. The production of semi-conductor equipment for more general applications will also be undertaken.

FAWCETT PRESTON & CO., LTD., Bromborough, Cheshire, and FINNEY PRESSES, LTD., Birmingham, two wholly-owned subsidiaries of Metal Industries, Ltd., are to be merged on May 31. The combined company will be known as FAWCETT PRESTON & CO., LTD. (INCORPORATING FINNEY PRESSES). Manufacture is to be concentrated at Bromborough and the Birmingham works will eventually be closed. The joint selling organization of the two companies, Fawcett-Finney, Ltd., is to cease operations, and in future sales will be handled by Fawcett Preston & Co., Ltd. Arrangements have been made to ensure that production is not interrupted during the transfer of work from Birmingham to Bromborough.

Personal

MR. EWEN M'EWEN, M.Sc. (Eng.), M.I.Mech.E., M.Am.Soc.M.E., has been appointed director of engineering, Eastern Hemisphere, for Massey-Ferguson, Coventry.

Mr. M. S. Hunt

MR. SEBASTIAN Z. DE FERRANTI has been appointed managing director of Ferranti, Ltd., Hollinwood, Manchester. Sir Vincent de Ferranti will continue to hold the office of chairman of the company.

MR. MICHEAL S. HUNT has joined Midgley & Sutcliffe, Ltd., Hillidge Works, Leeds, 7, as sales manager. Educated at Rutherford Technical College, Newcastle-on-Tyne, he served his apprenticeship with Vickers Armstrongs, Ltd., Ellwick Works, Newcastle-on-Tyne. Since the war, he has been with C. C. Wakefield & Co., Ltd., in Yorkshire.

MR. J. J. LYNAM, of Huntacres, Harwood Road, Tottington, Near Bury, Lancashire (telephone number, Tottington 8199), who was formerly with Dean Smith & Grace, Ltd., and who, for many years, has represented John Lund, Ltd., is also to represent Stanley Machine Tool Co., Ltd., New Bank, Halifax, and Maiden & Co., Ltd., Hyde, Cheshire. He will cover Lancashire and the North West area.

Correction

In MACHINERY, 92/1185—16/5/58, reference was made to the appointment by B. Elliott (Machinery), Ltd., of Wickman, Ltd., as sole distributors in the United Kingdom for Victoria Victomatic 0-18 and 2-30 automatic cycle milling machines. We are asked to state that this arrangement does not cover Eire.

Performance of Synthetic Diamond

(*Continued from page* 1255)

fairly low. On the other hand, metal-bonded synthetic wheels have proved less satisfactory than those of natural diamond when applied in the normal manner. Similarly, the synthetic diamond does not perform well in cutting-off wheels, which are used with high feed rates and high unit pressures.

It is evident, however, that synthetic diamond in its existing form is already a valuable addition to the available abrasives. With further development work it may be possible to produce larger particles, up to, say, 20 mesh, also the additional strength desirable for cutting-off and metal-wheel grinding, and the field of application may then be considerably extended.

Obituary

MR. N. A. STEELE, B.SC., who was a director and secretary of F. E. Woodward, Ltd., Harrow Street, Wolverhampton, died recently. He had been with the company for 18 years.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £145; clean heavy copper, untinned and free from lead and solder, £140; second grade copper wire, £135; clean light copper, £130; braziery copper, £117; gunmetal, £121; brass mixed, £87; lead, net, £58; zinc, £28; cast aluminium, £88; old rolled aluminium £114; battery lead, £31; unsweated brass radiators, £70; hollow pewter, £495; black pewter, £365.

MIDLANDS.—The difficulties as regards trading in ferrous scrap have not lessened and during the period preceding the Whitsun holidays even more suspensions were in force.

Loads and wagons of heavy steel scrap are being moved to steelworks, but the rate of acceptance falls well below the tonnages available for immediate clearance. Several steelworks have had to put off men due to shortage of orders, and allocations are not likely to be increased in the immediate future. Outlets for light iron are extremely hard to find, and merchants are unable to load this type of scrap in its loose form. There are few markets for No. 9 turnings, and most of the chipped turnings forthcoming in this area are forwarded to the blast furnaces where acceptances are rather more general. Light steel cuttings to specification No. 11 are difficult to place, and only odd loadings can be made, the balance of material going to merchants' yards, at lower prices, for pressing. The prices for cast iron borings have shown a tendancy to ease as markets become fewer, and merchants must buy accordingly.

The foundry trade, too, is quiet, and only odd deliveries of short steel and cast iron can be moved. Drop forging stamping scrap is not wanted as short steel by the majority of foundries, and offers for this grade are consequently being reduced as contracts come up for renewal.

Prices for No. 1 wrought iron piling scrap and No. 2 shearable scrap, for delivery to ironworks in the Black Country area, have dropped by about 20s. per ton.

The movement of " bushy " turnings has been drastically curtailed due to the lack of loading permit labels, and many merchants are accumulating large demurrage accounts in respect of loaded trucks for which there is no outlet.

Oversize scrap for processing is moving slowly, at prices commensurate with the general recession in trading.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.
† George Cohen, Sons & Co., Ltd., 600 Commercial Road, E.14.
‡ Subject to market fluctuations.

Iron and Steel Import Duties

Under the Import Duties (Exemptions) (No. 10), (No. 12) and (No. 16) Orders, 1957, the import duties on a wide range of iron and steel products are suspended until September 18, 1958. After consultation with the Iron and Steel Board about the supply position, Her Majesty's Government have decided to prolong, until December 31, 1958, the suspension of import duty on (*a*) most types of cold-reduced sheets of a value of less than £90 per ton and (*b*) hot-rolled strip more than 18 in. wide in coils weighing more than 3 cwt.

A new Order, The Import Duties (Exemptions) (No. 8) Order, 1958 (S.I. No. 797) has been made and will come into operation on September 19, 1958. Copies of the Order may be obtained from H.M. Stationery Office or from any bookseller, price 3d. (by post 5d.).

Books Received

B.N.S. BUYERS' GUIDE FOR 1958 (Industrial Uses). British Nylon Spinners, Ltd., Promotion Department, 25 Upper Brook Street, London, W.1.

The eighth edition of this guide has recently been issued. It has been enlarged and the contents have been rearranged to facilitate reference. The various types of goods are listed in 70 major categories.

Machine Tool Share Market

Stock markets, which had been steady in mainly quiet conditions, became fairly active following the reduction in Bank Rate from 6 per cent to 5½ per cent, and the past week closed on a firm note.

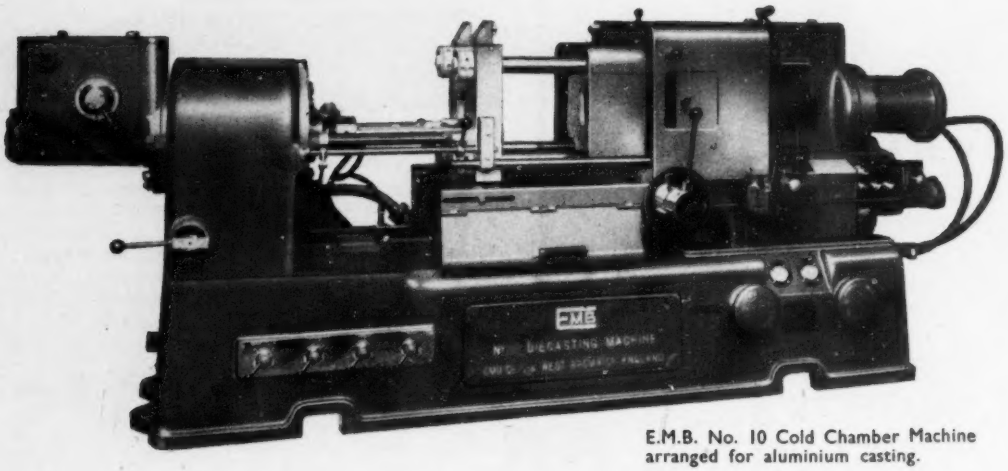
British funds, home corporations, and other first-class investment stocks registered an all round advance.

Among the principal sections of the industrial share market a satisfactory undertone prevailed. Although buying interest remained moderate and selective, and price movements showed some irregularity, the majority of changes were to higher levels.

Among machine tool issues, Arnott & Harrison advanced 6d. to 14s. 6d.; British Oxygen, 2s. to 34s. 6d.; Chas. Churchill, 1½d. to 4s. 7½d.; Kayser Ellison, 6d. to 45s.; and John Shaw & Sons (Wolverhampton), 3d. to 12s. On the other hand, Clarkson Engineers lost 3d. at 12s. 3d.; Churchill Machine Tool, 4½d. at 18s. 3d.; and Sheffield Twist Drill, 1s. 3d. at 33s. 9d.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	7/10½
Allen (Edgar) & Co., Ltd.	Ord.	£1	27/6
" " "	5% Prf.	£1	14/9*
Arnott & Harrison, Ltd.	Ord.	4/-	14/6
Asquith Machine Tools Corp., Ltd.	Ord.	5/-	18/1½
" " "	6% Cum. Prf.	£1	18/6
Birmingham Small Arms Co., Ltd.	Ord.	£1	28/6
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum. "B" Prf.	£1	17/9
" " "	4% 1st Mort. Deb.	Stk.	85/-
British Oxygen Co., Ltd.	Ord.	£1	34/6
" " "	6½% Cum. Prf.	£1	21/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/7½xd
Broom & Wade, Ltd.	Ord.	5/-	10/4½
" " "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	14/9xd
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	18/6
Butler Machine Tool Co., Ltd.	Ord.	5/-	5/6
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/7½
" " "	6% Cum. Prf.	£1	26/3
Churchill Machine Tool Co., Ltd.	Ord.	5/-	18/3
" " "	6% Cum. Prf.	£1	18/6
Clarkson (Engrs.), Ltd.	Ord.	5/-	12/3
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/10½
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	13/3
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/9
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/9
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" " "	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-
Greenwood & Batley, Ltd.	Ord.	£1	46/10½
Harper (John) & Co., Ltd.	Ord.	5/-	13/9
" "	4½% Red. Cum Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	67/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/3
" "	"B" Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	45/-xd
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/3xd
Kitchen & Wade, Ltd.	Ord.	4/-	10/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	7/9
Modern Engineering Machine Tools Ltd.	Ord.	5/-	9/6
Newall Engineering Co., Ltd.	Ord.	2/-	4/6
Newman Industries, Ltd.	Ord.	2/-	2/3xd
" " "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	6/-
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	16/6
" " "	5½% Cum. Prf.	£1	25/3
Pratt (F.) & Co., Ltd.	Ord.	5/-	21/3xd
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	33/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	12/-
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	33/9
" " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	6/3xd
Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
" " "	4½% Deb. 1961-1977	Stk.	82/-xd
Wadkin, Ltd.	Ord.	10/-	18/9xd
Ward (Thos. W.), Ltd.	Ord.	£1	73/9
" "	5% Cum. 1st Prf.	£1	15/9
" "	5% Cum. 2nd Prf.	£1	24/9
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.



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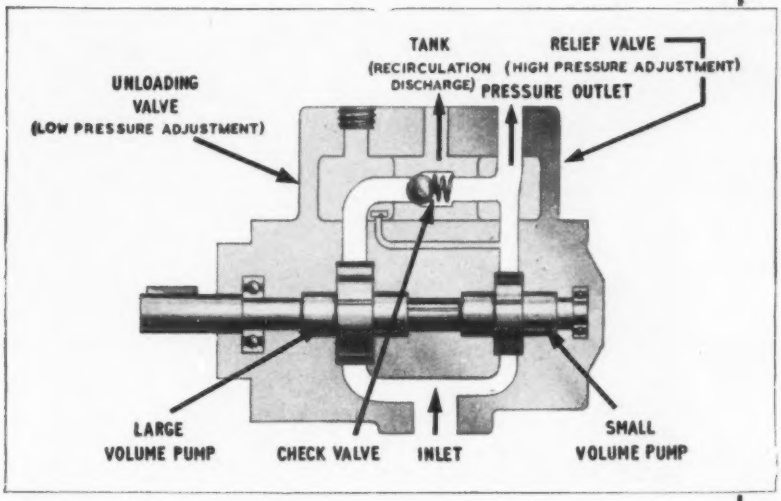

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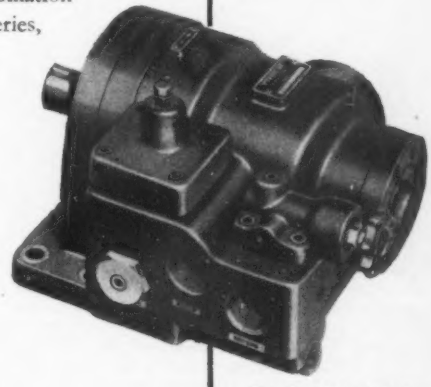

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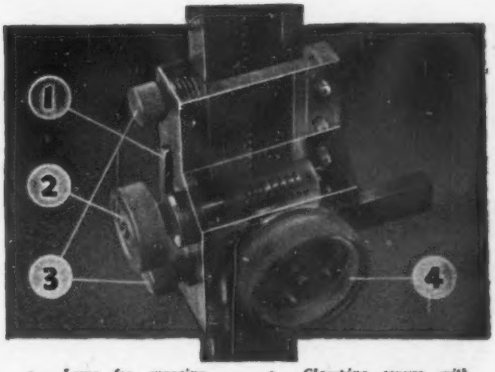

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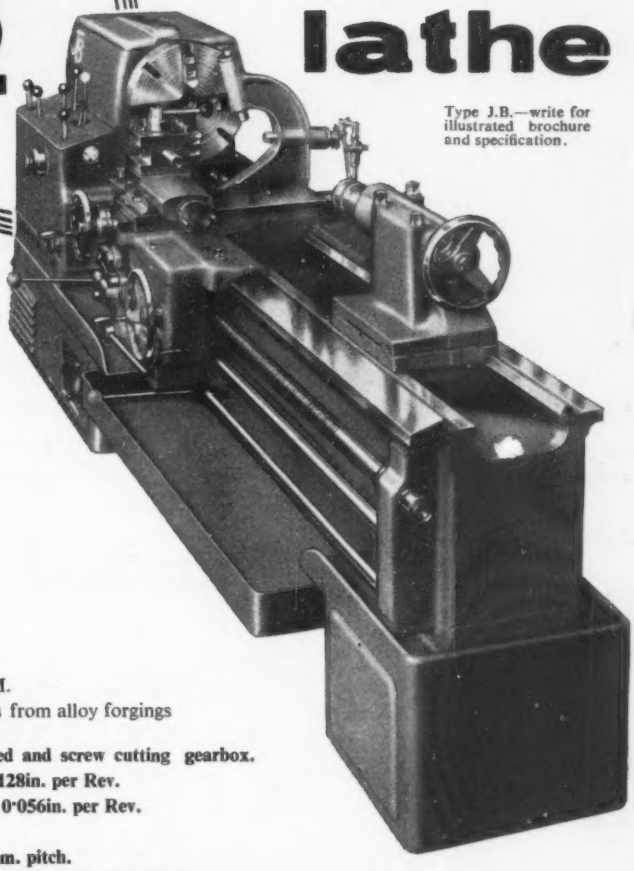

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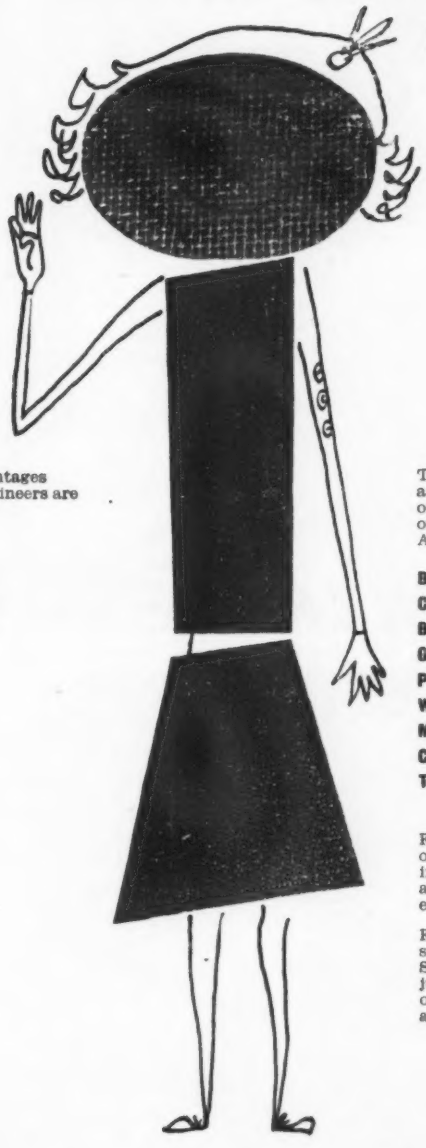

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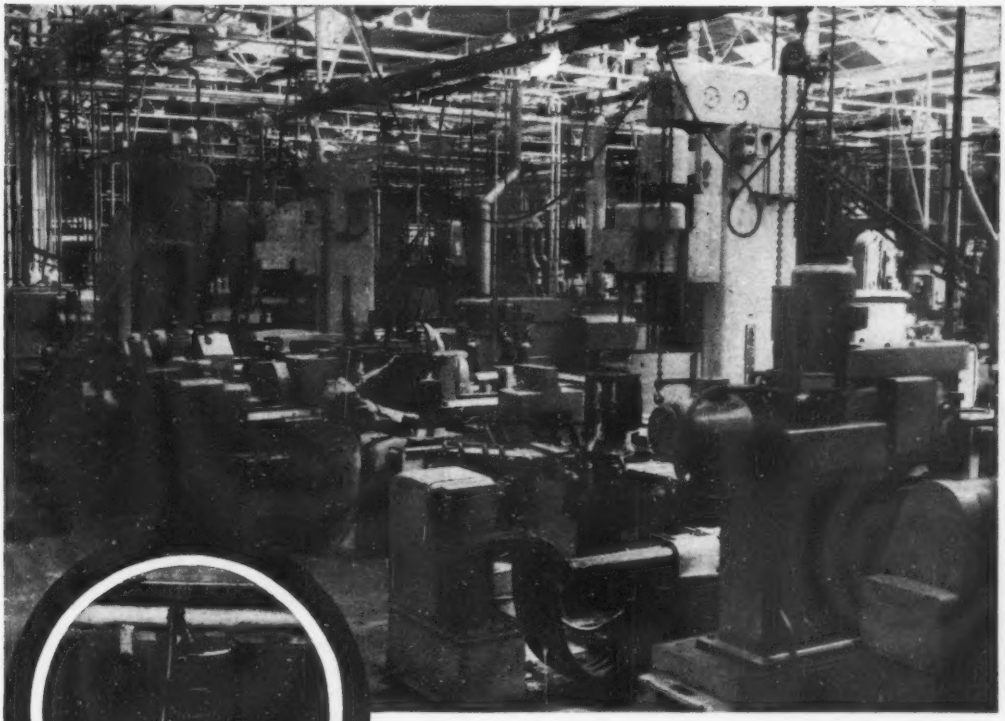

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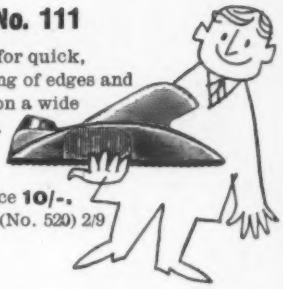

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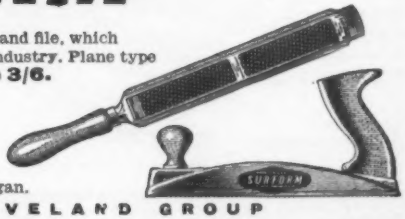

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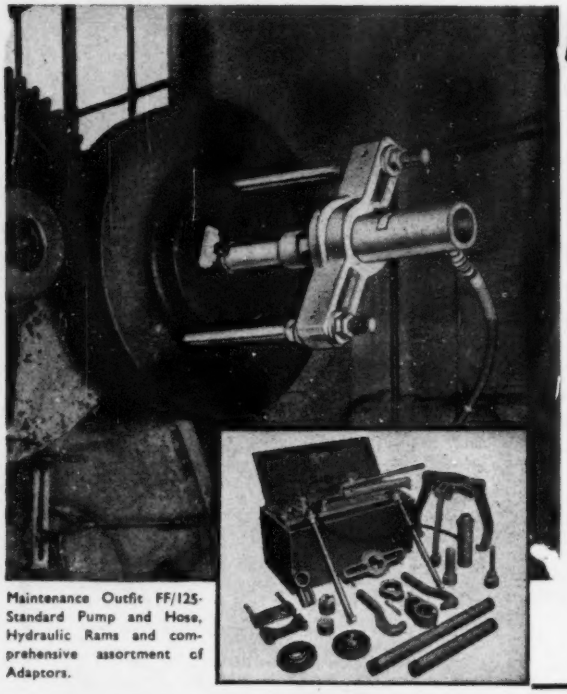

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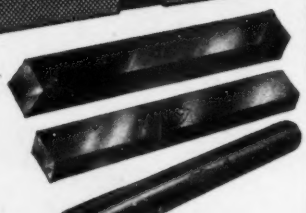

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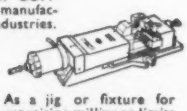

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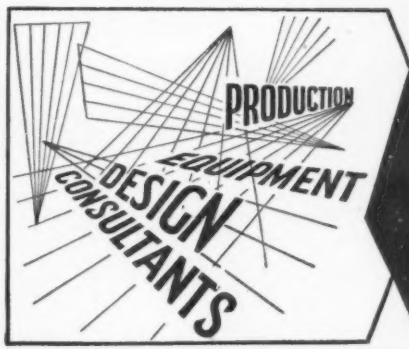

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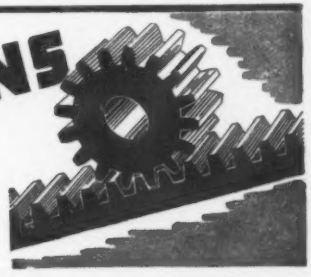

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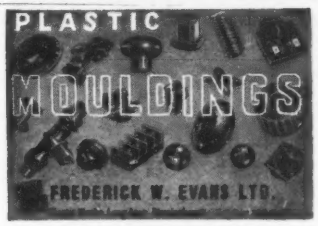

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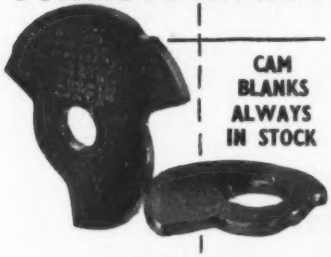

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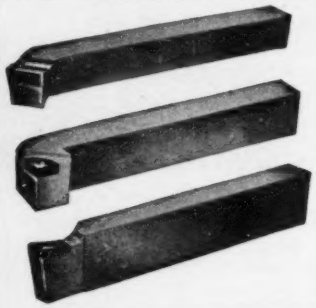

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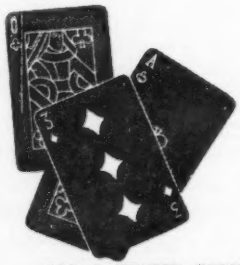

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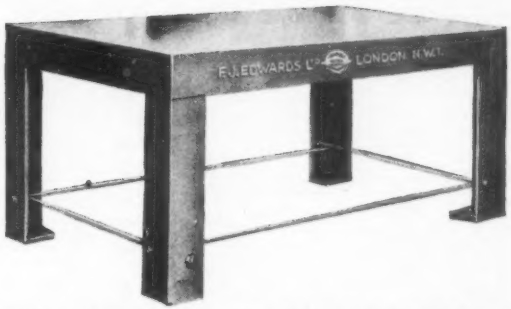

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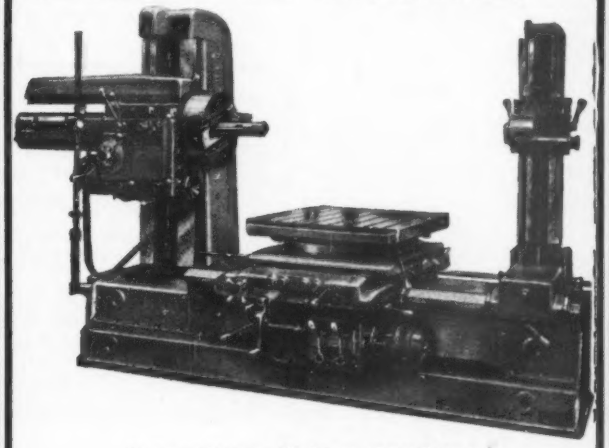

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ELECTRISKA 1¼in. cap. Geared 27in. Column Drilling Machine. (New.)
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EDWARDS 4ft. by 14g. Universal Swing beam Folder.
HENRY & WRIGHT 100-ton Dieing Press, modern machine with full equipment.
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NORTON Hori. Spindle Surface Grinder, 36in. table with 24in. by 8in. mag. chuck.
PALLAS Vertical Mill, sliding/swiv. head, table 44in. by 12in., old machine, good condition.
WARD 2A Capstan Lathe, bar feed, ball chuck, taper turn.
HERBERT No. 1 Capstan, dead length. chuck, bar feed.
SHAPE-RITE 8in. Bench Shaper.

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ACME GRIDLEY 1in. cap. six-spindle bar auto. Bar feed, collets tooling and live spindle.

BROWN & SHARPE 2G Auto, 1in. cap. Bar feed and tooling.

HERBERT Junior Chucking Auto. 6in. swing. Very well equipped.

FISCHER KDM 11/70 Copying Lathe. Automatic. 1954 machine.

HERBERT No. 4 Capstan A.G.H. eight speeds. 30 to 750 r.p.m. Covered bed.

BROWN & SHARPE No. 2 Universal Grinder. 14½in. swing by 28in. b.c. Well equipped. First class condition.

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HERBERT No. 7 Combination Turret Lathe. Screwcutting. 2½in. hollow spindle.

HERBERT 21 Combination Turret Lathe. 34in. swing. 7½in. hollow spindle. Screwcutting and Taperturning.

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ORMEROD 26in. Slotter.
HERBERT No. 7 and 8 Combination Turrets.
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HERBERT 48S Bar Capstan Lathe, fitted turret toolholders, pump, bar feed, speeds 30 to 511 r.p.m.
WARD No 7 Bar Capstan Lathe, bar feed, speeds 20 to 416 r.p.m.
HERBERT No. 20 Combination Turret Lathe, 7½in. diameter spindle, 28in. swing over bed, 97in. distance spindle to turret. Speeds 5 to 201 r.p.m.

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DEAN SMITH & GRACE Model "AN" 7½in. by 48in. S.S. & S.C. Straight Bed Lathe, speeds 11 to 490 r.p.m. Serial No. 20300.
WILLSON Mark V 7½in. by 48in., S.S. & S.C. Gap Bed Lathe, admits 48in., speeds 54 to 954 r.p.m. and 37 to 739 r.p.m. NEW.
DEAN SMITH & GRACE Type "A" 7in. by 31in. S.S. & S.C. Gap Bed Centre Lathe, speeds 11 to 490 r.p.m. Serial No. 21303.
REIDEN 7½in. by 40in. S.S. & S.C. Gap Bed Toolroom Lathe, fitted taper turning attachment, pump, 3-jaw chuck, speeds 25 to 1,350 r.p.m. NEW.
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MYFORD M.G.12 Plain Cylindrical Grinder, capacity 5in. by 12in. NEW.

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CINCINNATI No. 4 Dial Type Vertical Milling Machine, table 78½in. by 16½in. rapid and power traverses 42in. by 16in. by 16in. Speeds 18 to 1,300 r.p.m. British built 1941.
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VICTORIA U.2 Universal Milling Machine, table 45in. by 11in., power feeds 29½in. by 65in. by 16in., speeds 30 to 1,010 r.p.m. NEW.
RICHMOND No. 3 Universal Milling Machine, table 48in. by 11in., rapid and power traverses 30in. by 8in. by 16in., speeds 20 to 1,000 r.p.m. NEW.
DENBIGH C.4 Universal Milling Machine, table 46in. by 10in., automatic longitudinal feed 36½in., speeds 13 to 400 r.p.m. NEW.

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ARCHDALE 20in. Plain Horizontal Milling Machines, table 40in. by 10in., traverses 20in. by 5½in. by 12in., speeds 30 to 615 r.p.m.
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LUMSDEN Type 30R Four Wheel Ardoloy Wet Tool Grinder.

PRECIMAX 5in. by 18in. MPO Plain Cylindrical Grinder. 18in. wheel. Machine complete.

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ARCHDALE Plain Horizontal Milling Machine. Table 48in. by 13in. Spindle speeds 30 to 462 r.p.m.

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ASQUITH Single Spindle Profile Milling Machine. Type LDP. In new condition.

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WARD No. 7 Comb. Turret Lathe, 1940.
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ACME-GRIDLEY RAC6 Chuck Auto.
CHURCHILL No. 1 Planetary Grinder.
ORCUTT HM24 Gear Grinder, 1944.
CINCINNATI 1/18, 2/24 Prod. Mills.
RYDER WELLMAN Horiz. Borer, 3 insp.
B. & S. OOG S.S. Autos. 1942.
LA POINTE 2SL Horiz. Broach.
VICTORIA U2 Mill, with dividing hds., 1955.
ACME GRIDLEY 2¼in. S.S. Auto, 1942.
MODERN 6in. × 18in. Surface Gdr., 1953
CHURCHILL OSV 40in. × 10in. Vertical Spindle Surface Grinder, 1942.
ARCHDALE 30in. H.D. Pillar Drill, 1942.
GISHOLT 4, 5 and 1L Turret Lathes, 1941-43
WARNER & SWASEY 3, 5 and 3A Turrets.
HERBERT 2D, 4, 4 Senior Turret Lathes.
B. & S. No. 3 Vert. Mill, 1942.
WARD 2A and 3A Capstans, 1942.
ARCHDALE 18in. and 30in.Vert. Mills, 1942.
CINCINNATI 2MH & No. 2 Plain Mills, 1942.
HEALD 48A S. End Boremastics, 1941-44.
DEFIANCE No. 5 Hor. Borer, 3in. sp., 1941.
B.S.A. ¾in. S.S. Automatics, 1941.
CINCINNATI 1L and No. 2 Vert. Mills, 1942.
B. & S. No. 2 Universal Grinders, 1941.
NEWALL 10 by 74/48 Grinders, 1942.
MONARCH Magnamatic Prod. Lathe, 1946.
ORCUTT 5in. by 36in. Spline Grinder, 1944.
V.D.F. 10in. by 72in. Centre Lathe, 1941.
CINCINNATI 3/24, 3/36 Hydromatics, 1945.
HERBERT 0, 1 and 33 Plain Mills, 1940.
P. & W. 12H 2-spindle Profiler, 1941.
KITCHEN & WADE No. 2 Cyl. Hone, 1940.
CHURCHILL NB 6in. × 18in. S. Gr., 1942.
CHURCHILL Centreless Gr., Model EC, 1940.
COCHRANE BLY No. 55 Cold Saw, 1940.
INDEX OR12 S.S. Auto, ¾in. cap., 1940.
FOOTBURT 1in. cap. S.S. Automatic, 1943.

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Ward 3A: 1½in. Capacity Herbert and Atlas 1in. capacity, and Exacta ¾in. capacity Bar Capstan Lathes. Herbert 2¼in capacity Bar Turret Lathe. Gisholt No. 4 Simplified Chucking Capstan Lathe. All 400/3/50.—HICKS MACHINERY LTD., 26 Addison Place, London, W.11. Tel.: PARk 2333.

Henry & Wright 50-Tons 4 Column dieing press with roll feed for sale. Stroke 2in. Betweeen columns 13¾in. by 13¾in Daylight, stroke down, 10¼in. Top platen 21in. by 21in. Motor drive, 415/3/50.—Photo, etc., from F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

Perrin Jig Borer (Swiss), £550. B. & S. No. 13 Universal Grinder, £400. Taylor Band Saw, £75. Colchester 7in. Lathe, £100. Halifax 5in. Lathe, £30. Frickler Surface Grinder 14in. by 6in., £200. Gap Gauge Grinder, £40. Various small tools and equipment to clear.—'Phone: LIVingstone 1651.

⅜in. Single Spindle B.S.A. Automatic Screw Machine in excellent condition. Logan 5in. centre lathe. Chucks, etc.—CONWAY STEWART & CO., LTD., 36/44, Copperfield Road, E.3. ADVance 4422.

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GRAND RAPIDS HYDRAULIC SURFACE GRINDER No. 28

Capacity 8in. by 24in. Fully hydraulic table. Infinitely variable speeds. Automatic cross-feeds both ways. Grinding wheel 10in. dia. by 1in. Independent motorised wheel spindle. Through 1½ h.p. motor at 1,445 r.p.m. Micro-adjustment to wheel-head feed. 400-440 volts, three-phase, 50 cycles. Push-button starters. Coolant tank built-in with separate motorised pump.

MILWAUKEE 4K VERTICAL MILL

High speed series. Table 80in. by 16in. Longitudinal stroke 42in. 27 spindle speeds: 12 to 1,200 r.p.m. 27 feeds: ½in. to 15in. per min. Quick traverse all directions. Dial type gear change. Power feeds to vertical head. Built-in coolant system. Fully motorised 15 h.p., 400-440 volts, three-phase, 50 cycles. Push-button starters.

LORENZ GEAR SHAPER

Automatic high speed. Spur capacity 180 m/m. Spiral capacity 165 m/m. Width 50 m/m. Max. module 4. Automatic cycle. Coolant pump. Fully motorised 400-440 volts, three-phase, 50 cycles.

ARCHDALE VERTICAL MILL V. M. 30

Twelve spindle speeds 29 to 522 r.p.m. Table 44in. by 14½in. Automatic feeds: longitudinal 30in., cross 12in., nine table feeds. Fully motorised 400-440 volts, 3-phase, 50 cycles.

BROWN & SHARPE OMNIVERSAL MILL No. 0

Fully universal. Spindle speeds 40 to 1,300 r.p.m. Swivelling table 34½in. by 9in. with compound knee. Sixteen feeds ¼in. to 18¾in. per min. Equipment: Vertical head, Dividing head, Arbors, Cutter holders, etc. Motorised 400-440 volts, 3-phase, 50 cycles. IDEAL FOR DIE-MAKING TOOL-ROOM.

HACK MULTI-VERSAL MILL

Table 18" × 30½". Travel 19" × 11". Vert. stroke of ram 4" to 3½" × 100 strokes per min. Cuts keyways up to 2"; drills up to 1¼" diam.; end mill 4" max; face mill 8" max.; jig saws up to 3" tool steel. Spindle speeds: vert 80-2,500 r.p.m.; hor. 80-500 r.p.m. Equipment: one normal speed vert. head; Combination filer and slotter head. Fully motorised 400-440v. 3ph. 50c. CAPABLE OF 30 TYPES OF OPERATION, ROTARY AND RECIPROCATING. MAKES DIES AND TOOLS WITHOUT RE-SETTING.

CHURCHILL INTERNAL GRINDER. Type HBY

Fully hydraulic. Variable speed table traverse. 12in. swing. 12in. faceplate. Four workhead speeds. Workhead rotates for taper grinding 30 deg. Grinding spindle independent drive on counter balanced bridge with sensitive micrometer adjustment. Diamond dresser micro-adjustable. Automatic grinding spindle guard. Built-in coolant pump, tank base. Fully motorised 400-440 volts, 3-phase, 50 cycles. Push-button controls.

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CINCINNATI HIGH SPEED PRODUCTION MILL 1-18

Automatic hydraulic two-way cycle. Working surface 10in. by 35½in. Eight spindle speeds, 75 to 500 r.p.m. 16 feeds, 1in. to 40in per min. Quick traverse 300ft. per min. Fully motorised 400-440 volts, three-phase, 50 cycles. Push-button starters.

BROWN & SHARPE TOOL & CUTTER GRINDER

8in. dia. by 24in. between centres. Automatic table traverse. Four speeds. Swivelling table. Swivelling live work-head 160 deg. Vertical micro-adjustment to wheel-head slide. Fine and coarse feeds to table. Live work-head. Universal and other attachments. Independent motorised coolant unit. Fully motorised 400-440 volts, three-phase, 50 cycles. Push-button starters.

VAN NORMAN No. 6 RAM TYPE UNIVERSAL MILL

Nine spindle speeds 80 to 1,450 r.p.m. Table 30½in. by 6½in. Vertical head 90 deg. adjustment and rotates through 360 deg. Motorised 400-440 volts, three-phase, 50 cycles. Push-button starter. Equipment: Dividing head, etc. IDEAL FOR PROTOTYPE OR MOULD-MAKING.

PFAUTER GEAR HOBBERS R.1 & R.S.1

Max. dia. 29½in. without arbor. 15¾in. width. Up to 3 d.p., 11in. wide. Helix angles up to 60 deg. Takes hobs up to 5in. d. by 6in. Six hobbing speeds. Quick rise and fall. Motorised coolant pump. Fully motorised 400-440 volts, three-phase, 50 cycles. Push-button starters.

CARL UNGER CAM GRINDER

Fully hydraulic. Variable speed table. Table stroke 24in. 5in. swing by 24in. Variable speed work-head. Variable hydraulic picker feed to wheel-head. Grinding wheel 18in. dia. Master cam grinder and holder. Motorised coolant unit. Fully motorised 400-440 volts, three-phase, 50 cycles. Push-button controls.

KEIGHLEY CYLINDRICAL GRINDER

Fully hydraulic. Two-speed wheel-head, 2,000 r.p.m. max. 14in. wheel. 6½in. swing by 16in. Swivelling hydraulic table. Variable speed control. Hydraulic picker feed. All electric work-head with live and dead centres. D.C. rectifier giving six work-head speeds. Quick release tail stock. Diamond dresser attachment. Motorised built-in coolant system. 400-440 volts, three-phase, 50 cycles.

Further lists will be issued as discontinued products will make other plants available in the near future. For further details of above machines and details of future releases:—
Phone: MR. GANDER (Works Manager) at
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Cashmores

Selection of Machine Tools from Stock

CENTRE LATHES

LANG 8¼in. S.S. & S.C. Lathe to admit 4ft. 0in. between centres.
COLCHESTER MASCOT 8¼in. S.S. & S.C. Lathe, to admit 4ft. 6in. between centres.
New **MITCHELL OF KEIGHLEY** 12¼in. S.S. & S.C. Lathe, to admit 8ft. 9in. between centres.
VOLMAN 8in. S.S. & S.C. Gap Bed Lathe, to admit 4ft. 6in. between centres.
New **MITCHELL OF KEIGHLEY** 10¼in. S.S. & S.C. Lathe, to admit 7ft. 5in. between centres.
F.L.C.B. 13in. S.S. & S.C. Heavy Duty Lathe, to admit 17ft. between centres, 2 saddles.

CAPSTAN LATHES

WARD 3A Capstan Lathe, with collet chuck and bar feed, 1¼in. capacity.
WARD No. 7 Capstan Lathe, with covered bed, arranged for chuck work, 2¼in. hollow spindle.
WARD 2A Capstan Lathe, with collet chuck and bar feed, 1¼in. capacity.

BORING MACHINE

TULLIS Horizontal Boring Machine, Floor Type with 3¼in. traversing spindle, 9ft. 0in. by 2ft. 6in. tee-slotted baseplate.

UNIVERSAL GRINDING MACHINE

LANDIS 16in. by 36in. Universal Grinding Machine, with hydraulic feed.

DRILLING MACHINE

GIRARD 5ft. 0in Radial Drilling Machine, Elevating Arm, with Loose Box Bed, two motor type.

PLAIN GRINDING MACHINE

CHURCHILL 10in. by 36in. Hydraulic Plain Cylindrical Grinding Machine.

MILLING MACHINES

HERBERT 23V Vertical Milling Machine, 68in. by 17in. table.
CINCINNATI No. 3 Dial Type Vertical Milling Machine, 62¼in. by 15in. table, motorised.
ARCHDALE 18in. Vertical Milling Machine, 38in. by 10in. table.
CRAVEN "Rigidmill" Production Milling Machines, working surface of table 39in. by 13in., spindle speeds 25-400 r.p.m. Two machines available.
EDGWICK 18in. Production Milling Machine, working surface of table 26in. by 12in.
New **VICTORIA** U1, U2 and U3 Universal Milling Machines.
ARCHDALE 20in. Horizontal Plain Milling Machine, 40in. by 10in. table.
CUTTAT HYPERMIL Production Milling Machine, 43in. by 10in. working surface of table, with 4 automatic cycles to table.

SAWING MACHINES

RUSSELL 20/24in. Cold Circular Sawing Machine, with hydraulic clamping to vice.
NOBLE & LUND 11/16in. Cold Circular Sawing Machine.

SHEARING MACHINE

RUSHWORTH 10ft. 0in. by ¼in. Overcrank Guillotine Shearing Machine.

SURFACE GRINDING MACHINES

EXCEL No. 3A Hydraulic Horizontal Spindle Surface Grinder, 24in. by 8in. capacity.
LUMSDEN 92LE Vertical Spindle Rotary Table Surface Grinder, 48in. diameter table.

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K·E·N·T

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Abwood Vertical Spindle Surface Grinder. £175.
Autometric Jig Boring Machine. £525.
Progress 4E Drilling Machine. £140.
Parkson Horizontal Milling Machine. Table 51in. by 11in. overall. £195.
Speedax No. 2 Riveter. £35.
Jos. Heap 1in. Tangential Screwing Machine. £165.
Ward OE Capstan. Bar feed. £165.
Hardinge Precision Lathe, 5in. £37 10s.
Peterman P.10 S.S. Auto. Extensive collets and equipment. £395.
Willson 7½in. S.S. & S.C. Lathe. £235.
Lang 8¼in. S.S. & S.C. Lathe. T.T. A.G.H. £695.
Van-Norman 22L Hori-Vert. Milling Machine. £695.
Archdale 18in. Vert. Milling Machine. Fixed head. £250.

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CHURCHILL OSV Vertical spindle Hydraulic Surface Grinder, reciprocating table 60in. by 10in., max. under new wheel 10in., table speed hydraulically variable up to 100ft. per minute.

B.S.A.-GRIDLEY Model 'R', 1⅜in. capacity 4-spindle Auto. motor driven, fitted overhead toolslides complete with stock reels and tooling.

GLEASON 18in. Combination Gear Lapping and Testing Machine.

PITTLER Model RE.11.60 Turret Lathes, high speed, height of centres 8⅜in., 2⅜in. hollow spindle, 16 speeds 15·5 to 750 r.p.m.

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CINCINNATI Model 08 Production Millers, table 18⅜in. by 6¼in., auto feed 8in., with Servo attachments, auto-cycle.

CINCINNATI No. 2 Vertical dial-type Millers, table 52⅜in. by 12¼in., auto feeds and rapid power traverse all directions, longtl. 28in., vertical 13in., cross 12in., head travels 6in., centre of spindle to column 14in.

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WICKMAN ⅞in. capacity Sliding Head Precision Auto. with 3-spindle Attachment high speed drilling and screwing slotting attachment, bar feed and pump.

CLIFTON & BAIRD 30in. Metal Cutting Bandsaws, table swivels for mitring.

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ARCHDALE 28in. Horizontal Plain Miller table 49in. by 13in., 3-way power feeds and rapid power traverses.

WANDERER OFV. Vertical Mill swivelling head, table 39½in. by 10in., top speed 1,075 r.p.m.

CHURCHILL HBA Automatic Sizing hydraulic Grinding machines, swing in side water guard 12in., over table 19in., work table traverse 18in., range of work speeds 97 to 347 r.p.m., max. speed of hydraulic table traverse 360in./min.

RYDER No. 6 Verticalauto capacity 6in. by 6in., 6-spindle speeds 50 to 1,500 r.p.m., feeds 17¼in. to 320 c.p.i., turning slides length 6¼in., on cearse, 4in. on fine cam, forming slides length 4¼in., number of tooling stations five.

PLAUERT No. 70 Horizontal Boring machine 2⅜in. dia. traversing spindle swivelling table 40in. by 32in., fitted with screwcutting.

CHURCHILL-CONOMATIC 6-spindle 1¼in. capacity Automatic, max. travel main end slide 6in., max. travel main cross slides 4in., main stock feed 8¼in.

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ALL MOTORS 400-440-v. 3-phase, 50-cycle SUPPLY

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Woodhouse & Mitchell 369 Turret Mill, 36in. by 9in. table, power-fed table, motorised 400/3/50. Two months old.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

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New Wire Straightening Machine for sale. Motorised 400-440/3/50. All steel fabricated body on four wheels, for portable use. Capacity 4 mm. to 12 mm. with 5 hardened steel guide bushes for 4, 6, 8, 10 and 12 mm. wires. Straightening speed 80ft. per min.—Photo, etc., from F. J. EDWARDS, LIMITED, 359, Euston Road, London, N.W.1.

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ACME-GRIDLEY, Type R, 4-spindle, ⅞in. capacity.
ACME-GRIDLEY, Type R, 4-spindle, 1⅛in. capacity. (2 machines.)
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New GRAFFENSTADEN AF.075 Horizontal Borer, 3in. dia. travelling spindle, 17⅞in. dia. faceplate.

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HERBERT No.0 ⅝in. collet cap. (2).
MURAD ⅝in. Capstan Lathes (2).
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GISHOLT No. 4 Friction Head Capstan.
LIBBY 4R 2in. Capstan Lathe. Bar feed.
BARDONS & OLIVER No. 5 Capstan Lathe.
HERBERT No. 7 Turret Lathe.
FOSTER No. 2B Turret Lathe.

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New COLCHESTER CHIPMASTER, 5in. by 20in.
SOAG OXFORD 6½in. Centre Lathe.
SOUTHBEND 13in. swing taper turning.
WILLSON 8½in. A.G.H. Lathe.
CARDIFF 8½in. by 48in. Lathe.
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MILLERS.

New CHRISTEN Swiss Universal Tool and Die Mill.
HERBERT No. 1 Horizontal.
New VICTORIA U1 and U2 Universal.
ARCHDALE 20in. Horizontal Mills (3).
ARCHDALE 28in. Horizontal Mill.
OLIVETTI FP2 Manufacturing Miller. Table 52½in. by 14½in. Longitudinal traverse 39½in.
New GRAFFENSTADEN Model GH3 Plain Horizontal, table size 67½in. by 16½in.
New TAYLOR Vertical, table 17½in. by 5½in.
RICHMOND VHM Vertical Mill
New VICTORIA V2 Vertical.
New GRAFFENSTADEN FV.102 Vertical Mill. Table 51in. by 11½in.; 39½in. longitudinal traverse.
HOLROYD T117 Thread Miller.
HELLER Automatic Thread Millers (4).

MISCELLANEOUS.

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New RICHMOND SR2 3ft. Radial Drill.
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New Q. & S. Pillar Drill, 1¼in.
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NORTON 18in. × 6in. Surface Grinder.
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WOTAN Internal Grinder.
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LEBLOND 8in. Centre Lathe.
LODGE & SHIPLEY 12in. S.S. & S.C. Lathe.
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TATE

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Two **CINCINNATI** 4-48 Simplex Hydromatic Millers.
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PALLAS HO Plain 30in. by 8in., with Vertical Head.
PALLAS HOO Plain, 22in. by 7½in.
CINCINNATI Plain, 30in. by 8in.
WADKIN LXA 36in. by 12in., Vertical for alloy, etc.

GRINDING

JONES SHIPMAN Fig. 1204 EIUR, 8in. by 22in. Universal (nearly new).
MYFORD MG9 5in. by 9in. Int. and External (three years old).
MYFORD MG12 5in. by 12in. Int. and External (one year old).
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JONES SHIPMAN Fig. 138 Universal 10in. by 27in.
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JONES SHIPMAN Fig. 540 18in. by 6in. Surface, Chuck and Coolant (1954).

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CARDIFF 7in. Lathe (1952).
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MITCHELL 6½in. by 60in. Gap Bed Lathe (1952).
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GROB Type 614 Bandsaw on stand. **£70**

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SOAG

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POWER PRESSES
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If you do not wish your reply to any Box No. advertisement in this section to be forwarded to certain firms, please advise us. Your reply will then be destroyed, but you will not be notified as this would disclose the identity of the advertiser.

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